Final

**Preliminary Remediation Goals (PRGs)
for Derecktor Shipyard/Coddington Cove**

November 1998

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Reference: CLEAN Contract No. N62472-90-D-1298
              Contract Task Order No. 0302

Subject: Final PRGs for Derecktor Shipyard/Coddington Cove
              Naval Station - Newport, Newport Rhode Island

Dear Mr. Shafer:

Enclosed you will find three copies of the Final Preliminary Remediation Goals for Derecktor
Shipyard/Coddington Cove. This report was prepared by our subcontractor, SAIC, who also co-
authored the Ecological Risk Assessment Report for this site.

If you have any questions regarding this material, please do not hesitate to contact me.

Very truly yours,

Stephen S. Parker
Project Manager

SSP/

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List of Acroynms and Units

ACL/MCL	Alternate Concentration Levels/Maximum Contaminant Concentration Levels
ADI	Average Daily Intake
AE	Average Exposure
AET	Apparent Effects Threshold
ARAR	Applicable or Relevant and Appropriate Requirements
AT	Averaging Time
AVS	Acid Volatile Sulfide
AWQC	Ambient Water Quality Criteria
BAF	Bioaccumulation Factor
BPJ	Best Professional Judgment
BSAF	Biota-Sediment Accumulation Factor
BW	Body Weight
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CF	Conversion Factor
CFR	Code of Federal Regulations
CoC	Constituent (Chemical) of Concern
CV	Coefficient of Variation
CWA	Clean Water Act
DEP	Depurated Sample
DQ	Data Qualifier
DoD	Department of Defense
DW	Dry-Wet Ratio
ED	Exposure Duration
EF	Exposure Frequency
ELU	Elutriate
EMAP	Environmental Monitoring and Assessment Program
EPA (USEPA)	Environmental Protection Agency
EqP	Equilibrium Partitioning
ER-L	Effects Range Low
ER-M	Effects Range Medium
ERA	Ecological Risk Assessment
FA	Freshwater Acute
FC	Freshwater Chronic
FCR	Food Consumption Rate
FFA	Federal Facility Agreement
FI	Factor Ingested
FS	Feasibility Study
HHRA	Human Health Risk Assessment

HI	Hazard Index
HQ	Hazard Quotient
HMW	High Molecular Weight
IF	Intake Factor
IR	Installation Restoration
L-CoC	Limiting Chemical of Concern
LADI	Lifetime Average Daily Intake
LOAEL	Lowest Observed Adverse Effect Levels
LMW	Low Molecular Weight
NA	Not Available
NCP	National Contingency Plan
ND	Non-Depurated Sample
NETC	Naval Education and Training Center
NOAA	National Oceanic and Atmospheric Administration
NOAEL	No Observed Adverse Effect Level
NOEC	No Observable Effect Concentration
NOEQ	No Observable Effect Quotient
OSWER	Office of Solid Waste Enforcement Regulations
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PRG	Preliminary Remediation Goal
PW	Porewater
RAF	Relative Absorption Factor
RAO	Remedial Action Objectives
RBC	Risk Based Concentration
RBV	Risk-Based Value
RCRA	Resource Conservation and Recovery Act
RfD	Reference Dose
RIDEM	Rhode Island Department of Environmental Management
RIDOH	Rhode Island Department of Health
RME	Reasonable Maximum Exposure
RPD	Relative Percent Difference
RPRG	Recommended Preliminary Remediation Goal
RSV	Reference Screening Value
SA	Saltwater Acute
SAIC	Science Applications International Corporation
SC	Saltwater Chronic
SD	Standard Deviation
SDWA	Safe Drinking Water Act
SEM	Simultaneously Extractable Metals

List of Acroynms and Units (continued)

SF	Slope Factor
SQC	Sediment Quality Criteria
SQRT	Square Root
STDEV	Standard Deviation
TBC	To Be Considered
TCLP	Toxic Concentration Leachate Procedure
TEV	Threshold Effects Value
TOC	Total Organic Carbon
TRV	Toxic Reference Value
TSCA	Toxic Substance Control Act
UCL	Upper Confidence Limit
URI	University of Rhode Island
WQC	Water Quality Criteria
WQSV	Water Quality Screening Value
μg/L	micro grams per liter
μg/g dw sediment	micro grams per gram of dry weight sediment
ng/g dw sediment	nano grams per gram of dry weight sediment
mg/L	milligrams per liter
kg/L	kilogram grams per liter

1. BACKGROUND AND OBJECTIVES

The purpose of this document is to present a plan for the development of Preliminary Remediation Goals (PRGs) for the offshore area of the Derecktor Shipyard/ Coddington Cove Superfund Site. The general framework for this activity was based upon the "Risk Assessment Guidance for Superfund: Volume 1 - Human Health Evaluation manual (Part B, Development of Risk-based Preliminary Remediation Goals, USEPA, 1991a).

The Derecktor Shipyard/Coddington Cove site is located at the Naval Education and Training Center (NETC), Newport, RI, located in the lower East Passage of Narragansett Bay. As a Department of Defense (DoD) facility, investigation and cleanup are conducted as part of the Navy's IR (Installation Restoration) Program, although requirements are also to be consistent with Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), pursuant to the Federal Facility Agreement (FFA) agreement of March 1992 between the Navy, USEPA and RIDEM.

As part of the IR Program, numerous investigations have been conducted to determine the type and extent of constituents of concern (CoCs) in soil, groundwater, and offshore sediment and shellfish, including associated risks to the environment and human health. Results of these investigations revealed elevated ecological and human health risks for offshore (e.g. sediment and shellfish tissue) media.

Based on the results of these investigations, the Navy will prepare a Feasibility Study (FS) for Derecktor Shipyard describing options for remedial actions. The remedy options will be evaluated with regard to effectiveness for meeting objectives for mitigation of existing and potential threats to public health and the environment. These Remedial Action Objectives (RAOs) are based on knowledge of the types of CoCs, the environmental media (e.g., soil, water, sediment) in which they are found or could be found in the future and the projected use of the site (Table 1).

Although it is recognized that the remedy will provide a mechanism to meet the RAOs, the spatial extent of the remedy will have to be sufficient to ensure that residual CoCs do not remain at levels higher than Federal and State Applicable or Relevant and Appropriate Requirements (ARARs) or To-Be-Considered (TBC) standards. The applicable chemical-specific ARARs/TBCs are likely to be focused on sediment as the media of concern.

Among the chemical-specific ARARs described in Table 2 are the Federal ARARs/TBCs derived from promulgated USEPA Water Quality Criteria and proposed USEPA Sediment Quality Criteria, which are intended to be protective of 95% of all aquatic species. The threshold chemical concentrations that comply with the ARAR or TBC criteria are called the PRGs for the site. The CoCs and associated concentrations to be used as PRGs are supposed to be risk-based, i.e., reflective of the results of the risk assessment with respect to the selection of those CoCs that "limit" remediation

(USEPA, 1991a). Here, "limiting" CoCs (L-CoCs) are those analytes that are responsible for much of the baseline risk (because of high concentrations and/or strong correlations with high toxicity), such that by cleaning up these CoCs to their PRG concentrations, other co-located CoCs will be cleaned up to levels much lower than their corresponding goals.

In this report, PRGs are developed to permit remedial alternatives evaluation in accordance with the requirements of the National Contigency Plan (NCP) and CERCLA guidance. Two threshold criteria (overall protection of human health and the environment, and compliance with ARARs) and one of five "balancing" criteria (reduction of toxicity) that are used to evaluate the RAOs are directly applicable to PRG selection. The other balancing criteria (long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability and cost) are evaluated in the FS that also directly affect the acceptability of various remedial alternatives. Hence, the PRGs developed in this report do not represent absolute levels which must be removed from the site, rather the application of the seven criteria with Trustee involvement will be necessary to select the Final Remediation Goals for the site.

Based on this information, the objectives of this investigation are as follows:

- Derive PRGs;
- Implement PRGs to determine potential spatial extent of remedial action;
- Assess PRG-based results against human health/ecological risk findings and ARAR compliance.

Derivation and implementation of PRGs are discussed in Sections 2.0 and 3.0, respectively. In Section 4.0, the effectiveness of selected PRGs are discussed relative to risk reduction achieved versus type and concentration of CoCs constituting the PRGs.

2. PRG DERIVATION

The objective of the overall PRG development process is to select the L-CoCs for the site and identify their respective concentrations that, when implemented as cleanup criteria, will focus remedial action in those areas where risk is higher than acceptable levels. Risk at the site is determined by aquatic, avian predator, and human health concerns, hence the derivation of PRGs to protect each of these principal exposure pathways is required. The general approach for PRG derivation is presented in Section 2.1; pathway-specific procedures and results are presented in Section 2.2, Section 2.3 and Section to 2.4 for aquatic, avian predator, and human health, respectively.

In the PRG development process, it is assumed that the final PRGs developed for various CoCs can be used as a basis for intercomparison of relative risks contributed by the CoCs, both within and between exposure pathways. Implementing aquatic PRGs for a few CoCs exhibiting the maximum observed exceedences of PRG concentrations would be assumed to be protective of all co-located CoCs contributing risk in the aquatic exposure pathway. The ability to draw such conclusions is critical to the derivation of "Limiting" PRGs as described throughout Section 2.0.

As indicated earlier, a second critical assumption in PRG development involves the degree to which the remediation of the chemical causing the highest risk will lead to reduction of risks caused by other CoCs. For the Derecktor Shipyard/Coddington Cove study area, all the various CoCs tend to be found in each environmental sample, such that it can be reasonably expected that a similar condition of co-located CoCs will exist for unsampled areas. In addition, any CoC found to be "limiting" at a given location and exposure pathway is included in the final list of CoCs selected for the pathway. Thus, when remedial technologies are applied, the implementation of the most conservative (i.e., limiting) PRG can be expected to lead to risk reduction for all CoCs at those locations.

It is important to note that the limiting PRG approach will be effective only when various chemical contaminants and exposure pathways remain co-located at the sampling location. "Dis-location" of CoCs from one another might arise from application of treatment technologies that preferentially remove one CoC class over another. Dis-location of pathways may occur if different remedial solutions for a given location are selected (e.g., monitoring to protect human health vs. capping to protect the marine ecosystem) to protect various classes of receptors (e.g., marine organisms, birds, humans). If either of these practices are instituted, then the available data must be re-evaluated for each CoC class and exposure pathway to ensure all receptors are adequately protected.

2.1. PRG Development Approach

It is the objective of PRG development to determine sediment-based concentrations which represent thresholds below which adverse effects on aquatic biota are not expected to be ecologically significant. Since sediments are the primary reservoir of shipyard-related chemical contamination, the primary exposure mechanism of concern to be addressed by PRGs are the CoC exposures which occur via sediment which may directly expose aquatic biota, or accumulate in tissues of prey organisms for terrestrial, avian, and human receptors. The exposure pathways being addressed by PRGs can vary greatly; in this document, the process is used to address bedded (i.e., in-place) and, resuspended sediment effects on aquatic biota, shellfish predation by avian predators and shellfish harvesting by subsistent fishermen in the Derecktor Shipyard Coddington Cove study area.

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The PRG process has been designed to address and integrate these various exposure pathways using a consistent and systemic approach. For the present report, PRGs for the four distinct exposure pathways are evaluated using standardized procedures; development of risk-based PRGs involves refinement of the CoC list and calculation of protective concentrations (derivation), followed by an analysis of site-specificity and practicality for supporting risk reduction (implementation). The general procedures outlined below in 5 steps (1-5) and in Table 3 are discussed in detail in later sections will be followed to derive candidate PRGs for the site. Steps 6 and 7 involve PRG implementation and assessment and are discussed in Section 3.

1. *Identify primary exposure pathways and select/derive benchmarks to express risks of CoC exposure to target receptors.* For the aquatic exposure pathways identified in the Marine ERA, the media of concern for PRG derivation is the concentration of CoCs in the water of bedded and resuspended sediments, while prey tissue residues are the focus of avian exposures. The principal pathway of concern for human health exposure was determined in the HHRA to be shellfish ingestion by subsistence fishermen. For aquatic pathways Water Quality Criteria and/or water-based screening values derived from sediment benchmarks are used. For avian predators and human health, the exposure pathway of concern are CoCs contained in biota; tissue residue benchmarks are based on safe levels of shellfish ingestion and require consideration of site-specific factors discussed in Step 2, below.

2. *Calculate site-specific no effect threshold concentrations for each CoC-receptor pair.* For each CoC, site-specific factors may exist that modify the degree of chemical exposure/bioavailability to target receptors. For the aquatic pathway, site-specific factors include the bound form of the CoC in the environment (e.g., some CoCs present as paint chips, scrap metal, sand blast material, etc.) which could result in CoC bioavailability being less than predicted directly by bulk sediment concentrations. Here, aquatic toxicity tests are used to discern possible site-specific modification in CoC bioavailability. Similarly, avian and human receptors may have varying CoC exposure depending on the age and weight of receptors and factors related to their feeding/harvesting habits.

   Using the site-specific information discussed above, the second step in the PRG development process is to calculate no effect threshold concentrations (NOEC) for each CoC and exposure pathway. The NOEC represents the highest chemical concentration for which effects are unlikely to occur. For example, if an effect was observed at 2, 3, and 4 ppm but not at 0.5 and 1 ppm, the 1 ppm concentration would be selected at the NOEC. Full details of the NOEC derivation are discussed on a pathway-specific basis in Section 2.

3. *Retain CoCs substantially contributing to risk.* An objective of PRG derivation is to identify and retain CoCs for which PRG implementation will lead to effective risk reduction at the site while eliminating other CoCs that would not. For this

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step, it was assumed that if a CoC was a substantial risk contributor, the highest concentration associated with toxic samples must be greater than the NOEC. All CoCs satisfying this requirement were retained for further consideration as PRGs.

4. *Evaluate the feasibility of the CoC and pathway-specific NOEC as a long-term remediation goal.* Because of the general exchange of water and sediment in the region of the study area, it must be assumed that it would not technically feasible in the long term to remediate to CoC concentrations that are lower than those generally found in the region. For this step, regional CoC concentrations were summarized and the greater of the NOEC and reference-based concentration was determined. The resulting value was adopted as the Threshold Effects Value (TEV) for each exposure pathway.

5. *Assess CoC exceedences of TEVs to identify "limiting," pathway-specific CoCs for PRG selection.* The CoCs and associated concentrations to be used as PRGs are supposed to be risk-based, i.e., reflective of the results of the risk assessment with respect to the selection of those CoCs that "limit" remediation (USEPA, 1991a). Here, L-CoCs are those analytes that are responsible for much of the baseline risk (because of high concentrations and/or strong correlations with high toxicity) such that by cleaning up these CoCs to their PRG concentrations other co-located CoCs will be reduced to levels much lower than their corresponding effects-based concentrations.

The approach for selection of L-CoCs for aquatic, avian and human health exposure pathways involved the straightforward application of pathway-specific TEV values to derive Hazard Quotients (HQs). These HQ values were inter-compared for each station and CoC to identify the L-CoC, e.g., that CoC-exposure pathway pair that represents the maximum TEV-HQ observed for the station. This procedure greatly reduces the reliance on assumption of CoC co-location across the site because the broad spatial distribution of sampling locations minimizes the potential that a novel CoC (unique in distribution, concentration or speciation) would be missed and thus fail to be included as a L-CoC.

6. *Calculate PRGs from TEVs.* Based on the selection of L-CoC and the media-specific concentrations that will achieve optimal risk reduction (TEVs), the TEV values are recalculated as necessary into appropriate (sediment-based) concentration (PRG) units to be implemented during site remediation. The calculated values are also discussed relative to traditional benchmarks so as to compare the relative degree of protection afforded to exposure pathways by site-specific and generic approaches.

7. *Evaluate the practicality of the PRGs for effective risk reduction.* In this spatial analysis, a candidate PRG that, upon implementation as part of a remedial

action, would result in risk reduction in the most affected areas should be favored over other candidate PRGs that do not. Note that this step, unlike the previous steps, is a qualitative, risk-based interpretation based on best professional judgment. In this analysis, the location of PRG exceedences (e.g., PRG-HQ > 1) for each of the L-CoCs is reviewed with respect to the spatial distribution and likelihood of observed risks at the site as concluded from the results of the ecological risk assessment (ERA) or human health risk assessment (HHRA). The extent of concurrence between the degree of apparent risk reduction and remediated area is discussed and presented as Recommended PRGs (RPRGs) so as to provide input into risk management decisions regarding the setting of Final Remediation Goals (established as part of the final Record of Decision for the site). As such, this focused discussion is intended to be primarily supportive of the FS analysis of the five balancing criteria (see Section 1) in which extent of risk reduction is assessed against monetary and engineering implications of remedial alternatives.

In summary, steps 1-5 above involve the identification of L-CoCs and matrix-specific (water, sediment, shellfish tissue) concentrations below which no adverse effects are expected. These steps are discussed in detail for aquatic, avian, and human health exposure pathways in Section 2.2 to Section 2.4, respectively; a summary of L-CoC selections is provided in Section 2.5. Separate from the above, steps 6-7 involve PRG implementation and assessment on a pathway-specific basis and are discussed in detail in Section 3.

2.2. Aquatic PRG Derivation

As identified in Section 1, five steps are required for aquatic PRG derivation. Each of these steps is fully addressed in the following sections.

1. Pathway Identification/Benchmark selection. The Marine ERA identified sediments as the principal exposure pathway of concern for aquatic receptors. Sediment Quality Criteria (SQC) for sediments and Water Quality Criteria (WQC) for surface waters are logical choices as ARARs for the Derecktor Shipyard/Coddington Cove study area. Although the direct applicability of SQC has been limited by the number of available criteria to date (presently five non-ionic organic compounds including three PAHs (acenaphthene (USEPA, 1993a), fluoranthene (USEPA, 1993b), phenanthrene (USEPA, 1993c) included as CoCs in the Marine ERA), the SQC derivation process has demonstrated the applicability of WQC to porewater concentrations for prediction of sediment toxicity when partitioning characteristics of the CoC between water and the organic carbon fraction of the sediment (K_{oc}) is taken into account using the equilibrium partitioning (EqP) model of Di Toro *et al.* (1991) as follows:

$$1) \quad C_p = C_s/(f_{oc} * K_{oc});$$

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In the above equation, organic chemical porewater concentrations (C_p, µg/L) are calculated from the corresponding sediment concentration (C_s; µg/kg), based on the fraction of organic carbon (Foc) in the site sediment; [foc = %TOC/100 (Total Organic Carbon)] and the organic carbon/water partitioning coefficient (Koc) for the CoC. Values for K_{oc} (Table 5) were determined from the relationship developed by the EPA (Karickhoff, 1989):

$$2) \quad \log_{10}K_{oc} = 0.00028 + 0.983 * \log_{10}K_{ow};$$

where K_{ow} = the octanol/water partition coefficient.

By adopting the EqP approach for the development of aquatic PRGs for the present investigation, the chemical concentration in porewater in relation to WQC is used as the primary measure of potential adverse effects (i.e., risk) to aquatic biota. The EqP model also allows incorporation of station-specific conditions (principally TOC content of sediment measured at the location) that control sediment-porewater partitioning and hence chemical bioavailability in bedded sediments. In contrast to the bedded sediment exposure pathway, direct measurements of CoCs in elutriates for the resuspended pathway obviates the need for partitioning calculations for this medium.

As discussed in Section 1, determination of organic and metal CoCs responsible for the majority of the risk is assessed through normalizing concentrations to benchmarks so as to adjust for differences in the inherent toxicity of the chemical. For this investigation, Water Quality Screening Values (WQSV) adopted primarily from EPA Water Quality Criteria - Saltwater Chronic (WQC-SC) values (or estimated equivalents, discussed below) were used as the benchmarks.

Water-based CoC criteria are proposed for calculation following the decision tree presented in Figure 2.2-1. This approach allows for calculation of "WQC-SC equivalent" benchmarks, and assigns a data qualifier (DQ) to identify the benchmark source for derivation of the HQ. In Table 4, the DQ "A" is applied to benchmarks derived directly from existing WQC-SC values. For CoCs possessing WQC-saltwater acute values (WQC-SA), an 8:1 acute:chronic ratio is applied to derive the equivalent WQC-SC value (DQ = "B"). The conversion factor was derived from the mean overall acute:chronic ratio for paired chemical data contained in the EPA AQUIRE database (Shepard, 1998). Freshwater chronic data (WQC-FC) are used directly as screening values, with assigned data qualifier "C". As with WQC-SA values, freshwater acute (FA) values were converted to chronic values using an 8:1 acute:chronic ratio, and assigned DQ = "D".

Some sediment-based correlative benchmarks are required to complete the assessment of site-related CoCs where water quality benchmarks are lacking (Table 4). In these cases, NOAA Effects Range-Low (ER-L) (Long et al., 1995) concentrations were selected and translated into porewater equivalent concentrations using the EqP model. In this process, it is assumed that the resultant value provides a level of

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protection equivalent to other water quality based benchmarks. This assumption is not unreasonable given that the WQC values are designed to be protective of 95% of all species, while NOAA ER-L values represent concentrations below which 90% of all sediment samples had no measurable adverse effect. Hence, sediment benchmark values (NOAA ER-L) were transformed into water-equivalent benchmarks using the EqP model by assuming 1% sediment TOC concentration (DQ = E). Finally, compounds for which no benchmark screening values were available are designated "NA" in Table 4.

Research by the USEPA into the development of SQC for divalent metals (Cu, Cd, Pb, Ni, and Zn) in sediment has shown that sediment toxicity can be predicted when the quantity of Simultaneously Extractable Metal (SEM) present in excess of the Acid Volatile Sulfide (AVS) concentration in sediment is measured (Berry et al., 1996). The expression of SEM relative to AVS has been historically expressed as the SEM/AVS ratio, although the difference of SEM and AVS (SEM-AVS) is now preferred, as the metric is less sensitive to conditions where AVS is near detection limits (e.g., resulting in very high SEM/AVS ratios). The use of SEM-AVS is based on the fact that AVS will bind divalent metals in direct proportion to their respective molar concentrations (Hansen et al., 1996). In the EPA National Sediment Quality Inventory (USEPA, 1996a) the SEM-AVS value of 5 µmol/g dry wt is recommended as a screening value for identification of bedded sediments of concern with regard to potential divalent metal effects on aquatic biota in bedded sediments.

The above application of SEM:AVS data to bedded sediments can be modified to be relevant to sediments recently deposited as a result of resuspension. By assuming that all AVS is oxidized during resuspension (AVS = 0) and that the SEM concentration of settled particulates is the same as that of bedded sediment (conservatively assuming no losses in the water column), the potential effect of metals in sediments subject to resuspension can be assessed by direct comparison of SEM metal concentration against the SEM benchmark (5 µMol/g). It is noted that this evaluation was also performed in the ERA (Table 6.1-1). The SEM-AVS method is not directly amenable to PRG development since it does not directly identify CoC-specific PRGs. However, the data are useful for evaluation of the overall need for metals-based site-specific PRGs.

The WQSV presented in Table 4 represent thresholds for adverse effects to aquatic biota as derived from available water quality criteria and modified sediment benchmarks. Porewater and elutriate concentrations (reported in Tables A-3.1 and A-4.1, respectively) are divided by the WQSV to obtain Porewater Hazard Quotients (PW-HQs; Table A-3.2) and Elutriate Hazard Quotients (ELU-HQs; Table A-4.2). These quotients are used to determine no effect concentrations as discussed in the following section.

2. *Calculate site-specific no effect threshold concentrations for each CoC-receptor pair.* A common element of correlative benchmark development is the process

of establishing statistical confidence limits for sediment concentrations with varying likelihood of biological effects. For example, the NOAA ER-L benchmark (Long and Morgan, 1990; Long et al., 1995) was developed by matching of chemical concentrations with incidence of benthic effects (e.g., toxicity, reduced benthic composition, biomarker response) measured in field samples, and statically estimating the sediment concentration below which no adverse effect was observed 90% of the time.

As introduced in Section 1, it is expected that site-specific factors exist which control the bioavailability of CoCs in the marine sediments of the shipyard/cove study area and thus modify the degree of chemical impacts on target receptors. For the present investigation, the primary indicator of site-specific CoC bioavailability in bedded sediment are toxicity results from the amphipod (*Ampelisca abdita*) 10-day bulk sediment test, while for resuspended sediments, results of the sea urchin (*Arbacia punctulata*) fertilization and larval development elutriate tests are used. An amphipod and sea urchin biotoxicity test was conducted at each location where a bulk sediment or elutriate chemistry sample was collected, respectively.

Adapting the general approach presented for ER-L derivation (discussed above), PW-HQ data were paired with co-located amphipod toxicity results, while elutriate hazard quotient (ELU-HQ) data were paired with co-located sea urchin toxicity results. The paired data sets were subsequently segregated in non-toxic and toxic samples defined for each as follows: amphipod survival $\geq$ 80% = non-toxic; sea urchin successful fertilization $\geq$ 70% = non-toxic, and sea urchin larval development $IC_{10} \geq$ 50% = non toxic. The PW-HQ or ELU-HQ database test endpoint are reported in (Tables A-3.3A, A-3.3B, A-4.3, and A-4.4).

The HQ databases include statistical summaries of the mean, maximum, and upper 95% of CoC-specific HQs. The non-toxic data sets available for derivation of no effect thresholds include 15 co-located stations for the bedded sediment pathway and 9-11 stations for the resuspended sediment pathway.

For each CoC, the highest concentration for which adverse effects are unlikely, called the No Observable Effect Quotient (NOEQ), was estimated as the upper 95% confidence limit (UCL) of the non-toxic PW-HQ or ELU-HQ data set (e.g., expected risk threshold at maximum CoC bioavailability). The 95% UCL approached was adopted as a method comparable to the USEPA WQC level of protection for chronic effects as calculated from single species/single toxicant bioassay results. For NOEQ values < 1, an NOEQ = 1 was adopted for the CoC assuming that it is unlikely that site specific factors could increase CoC bioavailability to levels above that occurring in water-only tests.

NOEQ results for the bedded and resuspended sediment exposure pathways are provided in Tables 5A and 5B, respectively. The listed CoCs include metals, PAHs, Total PCBs, and pesticides as well as aggregate values for Low Molecular Weight

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(LMW) PAHs, High Molecular Weight (HMW) PAHs and Total PAHs, and a sediment-based measure of divalent metal bioavailability (SEM-AVS). The aggregate CoC classes were included to address the potential additive effects of PAH and metal mixtures.

For most CoCs, the NOEQ was less than 1, indicating good agreement between measured toxicity and the literature-based WQC data; indicating that toxicity was not observed where criteria values predict that toxicity should not occur. In such cases where the *CoC-specific* NOEQ was less than 1, a NOEQ value of 1 was retained. For some CoCs, the NOEQ did exceed unity somewhat; this is attributed to the fact site-specific conditions have slightly reduced CoC bioavailability relative to conditions under which the WQC are derived (i.e., single-species, water-only laboratory bioassays). Here, the NOEQ was selected as the greater of the upper 95% HQ and the default HQ (e.g., HQ=1).

3. Retain CoCs substantially contributing to risk. Also listed in Table 5 are the maximum PW-HQ values for sediment samples found to be toxic to amphipods and maximum ELU-HQ values for elutriate samples found to be toxic to sea urchin larval development. No toxicity to sea urchin fertilization exposed to elutriates was observed in the ERA investigation. Those CoCs which were found to exceed the NOEQ benchmark (Max. HQ > NOEQ) for a given test endpoint were retained for further PRG derivation. For bedded sediment, the CoCs included HMW PAHs and Total PCBs. For resuspended sediments, CoCs included arsenic, copper, lead, HMW PAHs, Total PAHs, Total PCBs, and the pesticide o,p'-DDE. In assessing the potential for metals effects in resuspended sediment only four stations (DSY-27, 28, 29, 30) marginally exceeded the benchmark (e.g. SEM concentration >5 μmole/g), and only one station by more than a factor of two (DSY-27 12.1 μmole/g). Given that the SEM value the sum of five metals (Cu, Cd, Pb, Ni, Zn), and that AVS was extremely high in this sediment (176 μmole/g) it is unlikely that the combined effect of metals (let alone individual metals) are responsible for adverse effects at this or any other sample location.

The Aquatic NOEQ value used for further PRG development was taken as the minimum of the test-specific endpoints. Given the comparability of the NOEQ data among test endpoints and the observation that the calculated NOEQs are generally less than three (LMW and Total PAH for resuspended sediment was ~7.3), it is apparent that the site-specific CoC bioavailability is similar to that found for laboratory bioassay experiments. This good agreement is attributed to the fact that the test species employed in the Marine ERA are sensitive to site CoCs and serve as adequate surrogates for the most sensitive species in the shipyard/cove study area.

4. Evaluate the feasibility of the CoC and pathway-specific NOEC as a long-term remediation goal. Table 6 presents a summary of aquatic Reference Screening Values (RSVs) for the candidate CoCs identified in Steps 1-3, above. The database was assembled from measured or predicted porewater and elutriate concentrations at

reference locations used for the Allen Harbor (SAIC, 1996), McAllister Point (SAIC and URI, 1997a), and Derecktor Shipyard (SAIC and URI, 1997b) Marine ERAs (Table 6).

Prior to the use of these data, a limited assessment of these reference locations in lower Narragansett Bay to reference stations selected for the Derecktor Shipyard/Coddington Cove study area was conducted to demonstrate comparability of habitat and hence suitability as sites for background data. Data presented in Table A-2.2 show that the sand (66-88%), silt (12-33%), and TOC (1.1-1.7%) content for Derecktor Shipyard/Coddington Cove reference locations were within the range observed for Narragansett Bay stations as a whole; these similar geotechnical characteristics imply comparability of habitats. Hence it was assumed that the reference database can serve as suitable indicator of background CoC concentrations for derivation of aquatic PRGs.

In the development of the reference databases for the aquatic exposure pathways, the porewater reference data were screened for statistical outliers (defined as values greater than + 2 S.D. of the mean) to ensure that the RSV was not inappropriately elevated by atypical CoC distribution. The mean and 95% UCL of porewater concentrations after outlier removal were recalculated to obtain the RSV for the bedded sediment exposure pathway. In the case of the resuspended sediment scenario, only a single reference location (JPC-1) was measured for elutriate concentrations, hence the value obtained were used without modification.

Data for determination of aquatic TEVs are presented in Table 7. The Aquatic NOEQ values (from Step 3) were converted into the NOEC (e.g., water concentration units) to permit comparison against porewater and elutriate RSVs derived as described in Step 4. Subsequently the Aquatic TEV (AQ-TEV) was taken as the greater of the Aquatic NOEC and Aquatic RSV concentrations. The comparison of the two values show that the NOEC concentration exceeds the background concentration in most cases, suggesting that it would be feasible to remediate to the TEV concentrations, as background concentrations (represented as the aquatic RSV) would not be expected contribute to recontamination of the site. For lead and o,p'-DDE, however, the RSV exceeds the TEV, and thus the RSV is selected as the TEV for these CoCs.

5. *Assess CoC exceedences of TEVs to identify "limiting," pathway-specific CoCs for PRG selection.* As discussed in Section 2.1 (step 5), the list of CoCs to be retained as candidate PRGs are supposed to be "limiting", such that by cleaning up these CoCs to their PRG concentrations, other co-located CoCs will be reduced to levels much lower than their corresponding effects thresholds. In this step, the L-CoCs are derived by intercomparing TEV-HQs (in turn, derived from normalization of CoC concentrations in site to respective TEVs) and selecting the CoC with the maximum risk within and among pathways on a station-by-station basis.

To further ensure that all important L-CoCs be retained for the aquatic exposure pathway, the CoC with the maximum TEV-HQ for the station-pathway was selected

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whenever the station-pathway sum TEV-HQ > 1. This step was taken to further address the uncertainty in the co-location assumption by identifying any CoC which might substantially contribute to risk at the site. The process was repeated for all sampled locations to identify the collection of all possible L-CoCs. Because of the large number of stations used in this analysis (19) and the broad spatial distribution of sampling locations, the potential that a novel CoC (unique in distribution, concentration or speciation) would be missed and hence fail to be included as a L-CoC was greatly reduced.

Table A-5 presents the maximum observed TEV-HQs by exposure pathway and station. Results show that among all the possible CoC candidates for both exposure pathways, only a small number of CoCs had TEV-HQs > 1. For the bedded sediment exposure pathway, the two L-CoCs were HMW PAHs and Total PCBs. Arsenic, copper, lead, Total PCBs, and o,p'-DDE were identified as L-CoCs for the resuspended sediment exposure pathway. These CoCs are identified as Limiting CoCs in Table 7 which will be brought forward to Section 3.1 (Aquatic PRG implementation) for further development as PRGs.

It is noted that the application of a toxicity screen for the identification of L-CoCs did not appear to have greatly affected those CoCs which would have been selected based on direct WQSV comparisons alone. For porewater, SEM-AVS values suggest that divalent metals are not biologically available (SEM-AVS < 0, Table A-3.3A), hence analyte-specific porewater concentrations, although not measured, would be expected to be less than ambient water quality criteria. Some high molecular weight PAHs were predicted to exceed WQSVs (e.g., anthracene, benzo(a)anthracene, flourene, chrysene), but were not identified by the toxicity evaluation. In this case, however, these PAHs were addressed by adopting a HMW PAH aggregate PRG. Thus, while not specifically selecting these CoCs, the potential cumulative risks responsible from these PAHs were accounted for. Finally, pesticides were not identified in the toxicity screen, nor were any of these CoCs above WQSV values. Hence, it can be concluded that the toxicity screen did not exclude any key CoCs which might have been selected by the application of WQSV alone.

2.3. Avian Predator PRG Derivation

1. Pathway Identification/Benchmark derivation. Findings of the Marine ERA indicate that avian aquatic predators are at potential risk because of CoCs contained in the tissue of prey that they consume. Initial selection of CoCs and benchmarks for avian predator PRG derivation were based on the Derecktor Shipyard Marine ERA results comparing prey species tissue residue concentrations to Toxicity Reference Value (TRV) benchmarks for any CoC and predator-prey combination in the shipyard/cove study area (ERA Table 6.3-2). These TRVs already incorporate site-specific factors as described in Step 2, below. The resulting HQ values (TRV-HQs), derived as the prey species concentration (mg/kg dry weight) divided by the TRV

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(mg/kg dry weight), are reported in Appendix A-2-4 of the Final Marine ERA (SAIC and URI, 1997b).

2. *Calculate site-specific no effect threshold concentrations for each CoC-receptor pair.* Site-specific factors controlling CoC bioavailability to local birds selected for the ERA (great blue heron and herring gull) include the species, age and weight, and factors related to their feeding habits and migratory range in the New England region. The following description of methods and results for deriving TRVs for great blue heron follows is the same as used in the Marine ERA (Section 6.3).

A literature survey was conducted to identify studies where No Observed Adverse Effect Levels (NOAELs) and/or Lowest Observed Adverse Effect Levels (LOAELs) were determined for avian test species. The resulting data set included NOAEL/LOAELs for both domestic and wild birds; where possible, aquatic bird test data was selected in preference over data for other bird species. Subsequently, the equivalent NOAEL for the receptor of concern (wildlife NOAEL) was obtained by scaling the laboratory data (test NOAEL) on the basis of differences in body size according to the following equation:

NOAEL-wildlife = test NOAEL x [test bw/wildlife bw]$^{1/3}$ (Opresko *et al.*, 1994)

where: wildlife bw = body weight of wildlife species in kg
          test bw = body weight of laboratory species in kg
          test NOAEL = experimental dose in mg CoC/kg RoC/day

The TRV is defined as the concentration in food (in mg CoC/kg dry weight of food) which would result in a dose equivalent to the NOAEL (assuming no exposure through other environmental media), after Opresko *et al.*, 1996. The TRV was calculated from the food factor *f*, which is the amount of food consumed per unit body weight per day:

TRV = wildlife NOAEL/f (Opresko *et al.*, 1994)

Food factors for aquatic predators were derived from the Food Consumption Rate (FCR, in kg prey dry weight/day) and the receptor body weight (bw in kg):

f = FCR/bw (Opresko *et al.*, 1994).

For the Derecktor Shipyard ERA, the FCR for great blue heron were estimated from the allometric regression model of Kushlan (1978, as cited in USEPA, 1993).

3. *Retain CoCs substantially contributing to risk.* Using the above model and results for great blue heron, all CoCs with TRV-HQs > 1 were retained for further PRG derivation (ERA Table A-2-4.6). CoCs meeting the TRV-HQ >1 criteria include eight metals (arsenic, cadmium, chromium, copper, lead, mercury, silver, and zinc) as well as

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Total PCBs. Note that in the ERA, maximum TRV-HQs for the PAHs and pesticides were found to be uniformly less than unity and thus were eliminated from further development as PRGs for the avian exposure pathway.

4. Evaluate the feasibility of the CoC and pathway-specific no effect threshold concentration as a long-term remediation goal. As done for the aquatic RSV derivation, a reference database consisting of prey species tissue concentrations was developed for CoCs identified in Step 3, above, to derive Avian Reference Screening Values (AV-RSVs), being the mean + upper 95% confidence band statistics of reference tissue data after outlier removals. These results are reported in Table 8.

The resulting avian predator RSVs are compared against TRVs in Table 9 to evaluate the feasibility of implementation. The TRV values for cadmium, copper, lead, and mercury were higher than avian predator RSV concentrations, while the reverse was true for arsenic, chromium, silver, zinc, and Total PCBs. The avian TEV was taken as the greater of the TRV and avian RSV concentration to ensure that PRGs are not set to concentrations below regional background values.

5. Assess CoC exceedences of TEVs to identify "limiting," pathway-specific CoCs for PRG selection. Following the aquatic pathway procedure, the list of L-CoCs to be retained as candidate PRGs was derived by intercomparing avian TEV-HQs and selecting the CoC with the maximum risk for each station.

Results of this comparison are presented in Table A-6. Analytes identified as L-CoCs include copper, lead, silver, zinc and Total PCBs. These CoCs are identified in Table 9 and will be brought forward to Section 3.2 (Avian Predator PRG implementation) where a spatial implementation analysis will be used to determine the L-CoCs needed for protection of the avian predator exposure pathway.

2.4. Human Health PRG Derivation

Chemical-specific PRGs are concentration goals for individual CoCs for specific medium and land use combinations at CERCLA sites. Two general sources of chemical-specific PRGs for human health are concentrations based on ARARs and concentrations based on risk assessment. ARARs include concentration limits set by other environmental regulations (e.g., non-zero maximum contaminant level goals (MCLGs) set under the Safe Drinking Water Act (SDWA)). The second source for PRGs, and the focus of this section, is risk assessment or risk-based calculations that set concentration limits using carcinogenic and/or noncarcinogenic toxicity values under site-specific exposure conditions.

1. Pathway Identification/Benchmark selection. Findings of the HHRA indicate that consumption of shellfish containing elevated CoCs by subsistence fishermen is the primary pathway of concern for the Derecktor Shipyard/Coddington Cove study area.

Hence, the list of benchmarks for human health PRG development focus only on CoCs in shellfish tissue caught in the vicinity of Derecktor Shipyard/Coddington Cove. Four indigenous species were used in the Derecktor Shipyard HHRA (BRE, 1998) to characterize edible shellfish. This included hard shell clams (*Mercenaria mercenaria* and *Pitar morrhuana*), blue mussels (*Mytilus edulis*), and lobster (*Homarus americanus*). The CoCs determined to exceed the carcinogenic effects threshold representing a 1×10^{-6} probability of risk included arsenic, benzo(a)anthracene, benzo(a)pyrene, dibenz(a,h)anthracene, indeno(1.2.3-cd)pyrene, and Total PCBs. The HHRA also found arsenic concentrations in shellfish to exceed the non-carcinogenic effects threshold (e.g., HQ≥1). Based on these findings, this exposure pathway was evaluated for PRG development. The site-specific benchmarks for shellfish tissue residues, called Risk Based Values (RBVs), are derived as described in Step 2, below.

2. *Calculate site-specific no effect threshold concentrations for each CoC-receptor pair.* Threshold chemical intake rates assumed to be protective of potential adverse effects from carcinogenic and non-carcinogenic CoCs were used to determine no effect threshold concentrations in shellfish tissue, or RBC. The majority of exposure parameters needed for RBC derivation were obtained from USEPA Standard Default Exposure Factors (USEPA, 1993e), reported in Table 10. These same exposure parameters and values were used in the HHRA. The main site-specific parameter was the annual shellfish consumption rate for New Englanders published by Rupp *et al.* (1980). The survey showed the 95th percentile of total shellfish consumption for adults in the range of 18 to 65 years of age was 15.6 g/day (Rupp *et al.*, 1980). As had been done in the HHRA, it was conservatively assumed that all shellfish consumption by subsistence fishermen will occur in Derecktor Shipyard/Coddington Cove.

The CoC-specific RBC is typically taken as the concentration in shellfish which is unlikely to cause adverse health effects, even in sensitive populations (USEPA, 1991a). For non-carcinogenic CoCs, the RBC representing a baseline (HQ=1) hazard to humans from ingestion of CoCs is following USEPA guidance (USEPA, 1989a) as follows:

$$C, non\text{-}carcinogen\ (mg/kg\ wet\ tissue) = \frac{HI \times RfD \times BW \times AT}{IF \times CF \times FI \times EF \times ED \times RAF}$$

Where:

HI	=	Total Hazard Index; ratio of average daily intake level to acceptable daily intake level (unitless)
ADI	=	Average Daily Intake (mg/kg-day)
RfD	=	Reference dose (acceptable daily intake level; mg CoC/kg-day; see Table 11)
C	=	Concentration in shellfish tissue (mg/kg)
CF	=	Conversion factor (1 kg/10^3 g)
IF	=	Intake factor[1] (i.e., shellfish consumption rate, g/day)

FI	=	Fraction ingested (i.e., fraction of shellfish ingested)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
RAF	=	Relative absorption factor (unitless; analyte-specific; see Table 10)
BW	=	Body weight (kg)
AT	=	Averaging time (days)

Assuming the reasonable maximum exposure scenario is the reduced form of the equation using the site-specific exposure parameters from Table 10 is as follows:

$$C,\ non\text{-}carcinogen\,(mg/kg\ wet\ tissue)\ =\ \frac{4679.5\ \times\ RfD}{RAF} \quad (1)$$

For carcinogenic effects, a concentration range (i.e., the preliminary shellfish remediation goal range) is calculated which corresponds to a range between 10^{-4} and 10^{-6} incremental risk of an individual developing cancer over a lifetime as a result of exposure to the potential carcinogen from all significant exposure pathways for a given medium (USEPA, 1991a). This is based on USEPA's interpretation of the significance of the cancer risk estimate as stated in the National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR Part 300).

By setting the total risk for carcinogenic effects at a target risk level of 10^{-6} (the NCP's point of departure for determination of PRGs), the risk-based shellfish concentration (C) is calculated as follows:

$$C,\ carcinogen\,(mg/kg\ wet\ tissue)\ =\ \frac{Risk\ \times\ BW\ \times\ AT}{SF\ \times\ IF\ \times\ CF\ \times\ FI\ \times\ EF\ \times\ ED\ \times\ RAF}$$

Where:

Risk	=	The unitless probability of an exposed individual developing cancer
LADI	=	Lifetime average daily intake (mg/kg-day)
SF	=	Cancer slope factor $(mg/kg\text{-}day)^{-1}$

and remaining exposure parameters are as defined above. The equation shown below reflects the use of Reasonable Maximum Exposure (RME) parameters identified in Table 10.

$$C,\ carcinogen\,(mg/kg\ wet\ tissue)\ =\ \frac{0.011}{SF\ \times\ RAF} \quad (2)$$

The above equation is used to calculate CoC-specific threshold tissue residue concentrations below which adverse effects on subsistent shellfish consumers are not expected to occur. The CoC-specific parameters include RAF and SF values identified in Table 10 and Table 11, respectively.

Table 12 presents the calculated CoC-specific non-carcinogenic (Equation 1) and carcinogenic (Equation 2) RBC values assuming the RME exposure scenario. The overall Risk Based Values (RBVs) were taken as the minimum of RBC concentrations for each analyte. For comparison, the RBC concentration at 1×10^{-4} is also presented. As the RBV values will be compared against dry weight-based reference shellfish concentrations for the study area (Table A-2.4) and RBCs are calculated as wet (e.g. live) weight concentrations, % solids content (g dry/g live wt) statistics were developed for tissue samples to permit conversion of the RBV data to dry weight units. Data reported in Table A-2.3 indicates good agreement in solids content for various species allowing use of the average of 14% solids content (i.e., 86% water content) for conversion of wet weight values into dry weight concentrations. Thus, the RBVs for CoCs represent the dry weight shellfish tissue concentrations that are protective of subsistent fishermen consuming locally caught shellfish.

3. Retain CoCs substantially contributing to risk. All CoCs found in environmental samples above the RBV (as calculated in Step 2) are retained for further PRG derivation. In effect, the HHRA has already performed this calculation and identified these CoCs as presenting possible cancer and non-cancer risks although here threshold effect concentrations are also presented. A more detailed evaluation of the exposure assumptions (e.g., 10^{-6} vs. 10^{-5} cancer risk assumption) and exposure parameters will be performed to assess reasonableness during PRG implementation (Section 3.3). This will afford the opportunity to correct for overly conservative assumptions in the risk assessment and incorporate the most recent literature values published since the HHRA was completed.

4. Evaluate the feasibility of the CoC and pathway-specific no effect threshold concentration as a long-term remediation goal. The efficacy of these human health RBVs are further evaluated by comparison against human health RSVs derived from measured CoC concentrations in mussels and clams collected from reference locations (Table 13). These values are carried forward to Table 14, where Human Health TEVs (HH-TEVs) are obtained by selecting the greater of the RBV data and the RSV data. With the exception of arsenic, the RBV was higher than the reference (RSV) concentration. Elevated arsenic concentrations in shellfish tissues was addressed in the ERA and attributed to high arsenic in crustal materials typical of the Rhode Island formation (see text in ERA Section 4.3.1.1).

5. Assess CoC exceedences of TEVs to identify "limiting," pathway-specific CoCs for PRG selection. Following the same procedures as employed for the aquatic and avian predator exposure pathways, the list of CoCs retained as candidate PRGs for Human Health were derived by intercomparing TEV-HQs and selecting the CoC with the maximum risk within and among pathways on a station-by-station basis (Table A-7). The results indicate that arsenic, benzo(a)pyrene and dibenz(a,h)anthracene are L-CoCs for the human health pathway (Table 14). A single occurrence of TEV exceedence by dibenz(a,h)anthracene was noted for deployed mussels at off shore station DSY-39. Given that this media would not be available to shellfishermen and

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that other species collected from this location did not show similar exceedence, this analyte was not selected as a L-CoC. The above results demonstrate that relatively few CoCs account for the majority of risk in the study area, and further supports the selection of L-CoCs as PRGs for risk reduction at the site.

2.5. PRG Derivation Summary

The above PRG derivation process has identified pathway-specific L-CoCs and media-specific concentrations (TEVs) for protection of aquatic, avian, and human receptors. Table 15 presents a summary of maximum observed TEV-HQs observed by exposure pathway and station that constitute the list of L-CoCs for PRG implementation. Results show that among all the possible CoC candidates, only a small number of CoCs for the aquatic, avian predator, and human health observations, respectively, had TEV-HQs>1. For the bedded sediment aquatic exposure pathway, the two L-CoCs were HMW PAHs and Total PCBs, while arsenic, copper, lead, Total PCBs, and o,p'-DDE were identified as L-CoCs during resuspended sediment exposure. Additional L-CoCs included copper, lead, silver, zinc, and Total PCBs for the avian predator pathway, while arsenic and benzo(a)pyrene were identified for the human health pathway with the single exception of o,p-DDE (TEV-HQ = 0.8). The same list of CoCs is retained for all pathways combined.

The above results demonstrate that relatively few CoCs account for the majority of risk in the Derecktor Shipyard/Coddington Cove study area, and further supports the selection of chosen L-CoCs as PRGs for risk reduction at the site. It should be noted that the small number of identified CoCs is a reflection of the relative similarity of CoC bioavailability and related risk sources across the site. This observation provides some assurance that a novel CoC (unique in distribution, concentration or speciation) has not been missed and thus wrongly excluded as a L-CoC.

3. PRG IMPLEMENTATION

The second phase of PRG development involves a qualitative assessment of the practicality for spatial implementation, i.e., whether the spatial implementation of the PRG preferentially target areas of higher risk as identified in the Marine ERA (aquatic and avian) and HHRA. In this regard, candidate PRG values are "tested" through comparison against measured chemical concentrations at the site. This requires that the TEV values be translated into sediment based units (PRGs) so the available data at the site can be considered with respect to PRG compliance and risk reduction (Section 3.1). Subsequently, the relationship among the degree of risk reduction achieved in consideration of remediated area is discussed to recommend appropriate PRGs from a risk-based perspective (Section 3.2). These recommendations are used as input into the FS and resulting risk management decisions regarding the setting of Remediation Goals discussed in Section 3.3.

3.1. Translation of TEV Values into PRGs

3.1.1. Aquatic PRGs-Calculation Method.

With respect to the translation of the TEV for porewater and elutriate media back to sediment-based concentrations, the primary intention is to derive a PRG number that both protects the receptor, and when applied to measured sediment chemistry, reflects a comparable degree of risk as indicated by the matrix-specific risk indicator (i.e., the TEV-HQ). For example, a sediment porewater concentration at a given location that is two-fold above the TEV (e.g., TEV-HQ = 2) should ideally have a corresponding PRG concentration that, when implemented, will reduce the risk by a factor of two (e.g. from PRG-HQ = 2 to a PRG-HQ < 1). Inherent in this application of PRGs is the assumption that risk at a given location when expressed as a unitless quotient is the same regardless of whether the benchmark is TEV-based or PRG-based, thus:

$$\text{PRG-HQ}_{\text{Sta., CoC, Pathway}} = \text{TEV-HQ}_{\text{Sta., CoC, Pathway}} \quad (3)$$

Where the risk equivalency assumption in Equation 3, the previous statement holds true only for a given location, CoC, and exposure pathway.

The concept of cross-matrix risk equivalency is not new. This approach, for example, was used in the ERA to assess risks as a result of CoCs in tissues (from Shepard, 1998) based on WQC, wherein the tissue concentration in the biota achieved at the water-based effects threshold (e.g., WQC-chronic) is the relevant tissue-based effects threshold because CoCs must reach the site of toxic action (e.g., tissues) to exert their effect. Similarly, the degree of risk associated with porewater/elutriate concentration of causing the effect in bedded/resuspended sediment (i.e., TEV-HQ) must equal the risk associated with bulk sediment concentration (PRG-HQ) responsible for generating (via partitioning) that porewater concentration:

The relationship described in Equation 3 can be used to solve for the location-CoC-pathway as follows. Substituting for PRG-HQ:

$$\frac{[\text{Sed}]}{\text{PRG}} = \text{TEV-HQ} \quad (4)$$

Given the TEV-HQ and associated sediment concentration ([SED]), the PRG concentration can be solved:

$$\frac{[\text{Sed}]}{\text{TEV-HQ}} = \text{PRG} \quad (5)$$

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The important feature of this TEV-to-PRG translation method is that the measured risk data is used to derive the PRG value, whereas traditionally the EqP models would be used to back-calculate PRGs. In some cases, the models may still be needed, for example, where characteristics of a particular media sampled at a given location (e.g., TOC content of sediment, inert CoC materials such as metal fragments) result in an estimated PRG that is outside the expected range about the value at PRG-HQ = 1. In these instances, the predicted values can be validated against model estimates in relation to the model parameter inputs for the given location and the cause for atypical (high or low) PRG values can be isolated. In the present study, the procedure described above was used to calculate station-specific PRG estimates from which the mean PRG value was taken as the site-wide PRG concentration. Results of this process are discussed in Section 3.2.

3.1.2. Avian Predator/Human Health PRGs- Calculation Method.

The translation of both Avian Predator and Human Health PRGs require the conversion of tissue-based TEVs to sediment-based concentrations. This method of translation involves the application of Bioaccumulation Factors (BAFs) for metals and Biota-Sediment Accumulation Factors (BSAFs) for organics as discussed in the marine ERA (SAIC, 1997). For metals, the sediment-based concentration (μg/g gry wt) is calculated from the tissue-based TEV concentration according to the formula:

$$BAF = \frac{tissue\ concentration}{sediment\ concentration}$$

therefore:

$$sediment\ concentration = \frac{TEV}{BAF} \quad (6)$$

BAF values for arsenic (0.875), copper (0.33), lead (5.0E-6), silver (6.0E-4), and zinc (1.05) were derived in the Marine ERA (Marine ERA Figure 6.3-3).

For organic CoCs, the corresponding sediment concentration (ng/g dry wt) can be estimated from the formula:

$$BSAF = \frac{tissue\ concentration\ /\ lipid\ concentration}{sediment\ concentration\ /\ TOC\ concentration}$$

therefore:
$$sediment\ conc = \frac{TOC\ conc\ [TEV\ /\ lipid\ conc]}{BSAF} \quad (7)$$

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The site-specific BSAF values for PCBs, PAHs, and pesticides derived in the ERA were 5.00, 0.12 and 3.85 respectively (ERA Figure 6.3-2). These values were found to compare well with literature BSAF values reported by USEPA (EPA, 1998). Also assumed for the above calculation is a mean sediment TOC (2.78%; Appendix Table A-2.1), and a mean biota lipid (4.59%; Appendix Table A-2.3).

3.1.3. PRG Calculation Results

Table 16 presents a summary of calculated PRGs for each of the three exposure pathways using methods described in Section 3.1.1, above. The analyte list includes only L-CoCs, i.e., those CoCs identified in Table 15 as having the maximum TEV-HQ by station and pathway. For the aquatic PRGs, the station-specific estimates used to derive the site-wide baseline PRG (HQ=1) shown in Table 16 are reported in Table A-8. Baseline PRGs for Avian Predator and Human Health pathways were calculated directly from the TEV values presented in Table 9 and Table 14, respectively.

Also included in Table 16 are RPRG concentrations for aquatic, avian, human health and combined exposure pathways discussed in the Section 3.3-1, Section 3.3-2, Section 3.3-3, respectively based on spatial implementation considerations discussed in Section 3.2, below. Baseline PRGs for the combined exposure pathway were taken as the minimum of the pathway-specific baseline PRGs.

3.2. Approach for Spatial Implementation of PRGs

Implementation of PRGs to determine areas of potential remedial action requires that the CoC data obtained from point samples be assigned to non-sampled locations to produce a map of complete spatial coverage. Numerous methods for spatial extrapolation of point data to larger areas (such as contouring) have been developed for environments and sampling strategies in which the assumptions of continuity (e.g., constant CoC dilution with distance) and gradation (e.g., regular spacing of sampling locations) are met. In the case of the Derecktor Shipyard/Coddington Cove study area, these assumptions are not met because of heterogeneous CoC distributions and station clustering in focused areas. Thus, for this investigation, a method using Thiessen polygons was used as it does not require the presumption of continuity in the data (ESRI, 1989). An approach of this type was undertaken during the USEPA EMAP Demonstration Study for the Virginian Province (Weisberg et al., 1993). Here, the Thiessen polygon technique creates irregularly shaped polygons around sampled locations with a geometry such that any location in the polygon is closer to the sampled point than to any other sampled point. Hence, the concentration of the entire polygon is assumed to be equal to the value measured at the sampled location within the polygon.

The Thiessen polygon model constructed for the Derecktor Shipyard/Coddington Cove study area is shown in Figure 3.2-1. Geographic Information Systems software

(ESRI, 1989) was used for polygon construction and subsequent generation of PRG implementation maps. The inshore boundary of the site polygons was established as the shoreline at high tide, offshore polygons are unbounded. Shading of polygons obtained from PRG implementation will be used to demonstrate the locations in which CoC concentration data exceed the PRG (lightly-shaded), hence the area of potential remedial action. However, the polygonal area does not necessarily represent the final remediation area because the final area will depend on final PRG selection and additional sampling to improve spatial resolution.

Because it is desirable to use as much of the available site-specific data as possible to reduce spatial uncertainty, the Marine ERA evaluated chemical and biological results at 19 sampling locations throughout the Derecktor Shipyard/Coddington Cove study area (Stations 25-41) were combined with data from 24 stations obtained from a previous investigation (URI, 1993), hence accounting for the number of polygons shown in Figure 3.2-1.

Although both the ERA and URI investigations used similar sampling protocols and chemical analytical procedures, one notable difference was the depth of sediment sampling in the URI investigation (0-2 cm depth) vs. the ERA investigation (0-15 cm depth). The potential effect of this sampling variation on data comparability (hence usability) was evaluated by comparison of chemical results obtained from closely located stations between the two studies. The station pairs included DSY-1/40, DSY-1/41, DSY-2/28, DSY-3/29, DSY-10/41, DSY-11/31, DSY-18/26, DSY-19/32, DSY-20/31, and DSY-21/33 (Figure 3.2-1). The Relative Percent Difference (RPD) between stations for all stations and measured CoCs was 36%, while the mean RPD among PRG analytes for all stations was 47% (Table A-9). However, those stations within a proximity of 30 m had about a two-fold reduction in RPD relative to station pairs with >30m spatial separation.

Because the observed variation among datasets is well within the range generally considered to be acceptable among field duplicates (i.e., 30-40%), it can be concluded that the two data sets are sufficiently comparable to permit the incorporation of the URI data set into the PRG assessment. The data would further suggest that chemical distributions at the site are fairly homogeneous on the scale of 25-30 m. Heterogeneity on smaller scales (e.g., < 25 m) may represent 'hot spots' that were not detected. Still, the ERA sampling density was intended to characterize chemical risks at ecologically significant spatial scales, such that hot spots, if present, are more likely of ecological significance as potential CoC sources than for the loss of habitat.

Results of the Marine ERA have been used to classify the study area polygons based on the probability of adverse ecological risk caused by site-related CoCs to aquatic/avian aquatic receptors (Figure 3.2-2). The map shows the highest probability of adverse ecological risk ("+++") is occurring at harborfront stations DSY-27 and DSY-29 while the lowest probability of risk ("+") was observed for outer cove areas. The risk assessment for human health did not provide comparable spatial resolution,

but rather concluded that adverse risk to subsistence fishermen due to consumption of CoCs in biota does exist within Coddington Cove. Because the implementation of PRGs are intended to reduce risk, the spatial distribution of risk should be considered when evaluating the results of PRG implementation, discussed in the following section.

3.3. Assessment of PRGs for Risk Reduction

The assessment of PRG suitability as cleanup goals for the site involve the separate evaluation of L-CoCs listed in Table 16 as baseline (HQ=1) concentrations to determine the relationship between the degree of PRG exceedence and risk at the site. In the following sections, RPRG concentrations for aquatic, avian, and human health exposure pathways (discussed in the Section 3.3-1, Section 3.3-2, Section 3.3-3, respectively) are proposed that (based on best professional judgment) reflect a risk-based perspective on the optimal balance between degree of risk reduction and remediated area. These recommended values are further evaluated in the FS with respect to technical and fiscal constraints of PRG implementation.

3.3.1. Aquatic Exposure Pathways.

Bedded sediments. L-CoCs for the bedded sediment exposure pathway (Table 16) include HMW PAHs and Total PCBs.

HMW PAHs. The baseline PRG for HMW PAHs (6951 ng/g dry weight) was exceeded at eight shipyard/cove stations (DSY-2, DSY-3, DSY-18, DSY-19, DSY-20, DSY-27, DSY-29, and DSY-30; Figure 3.3-1). PRG exceedences were observed primarily for the harborfront stations, particularly Stations DSY-3/29 where PRG-HQs ranged from 4.3 to 10.5 (Table A-10). Another area in the vicinity of Station DSY-20 also exceeded the PRG by approximately three-fold, although closely located stations did not show similar exceedences (PRG-HQs <1 were observed for DSY-11 and DSY-31).

Among the stations exhibiting PRG exceedences, only Station DSY-29 was at high probability of risk, the extent PRG exceedences at this station (PRG-HQ= 4.3) and proximal station DSY-3 (PRG-HQ=10.5) indicate HMW PAHs are a significant source of risk. In contrast, the extent of PRG exceedences at low risk probability station DSY-30 (PRG-HQ = 1.49) are equivalent to that found at high risk Station DSY-27 (PRG-HQ=1.47), suggesting that PRG exceedences less than two are likely to preferentially address higher risk vs. lower risk areas. Further support for a RPRG equal to 2 times the baseline PRG (13903 ng/g) is seen in the risk/PRG comparison of the Station DSY-32 area; this location was classified as low risk while nearby station DSY-19 was exceeded the PRG by less than two fold. Similarly, PRG exceedence at Station DSY-18 (PRG-HQ = 1.86) is adjacent to intermediate risk station DSY-26 with no PRG exceedence (PRG-HQ < 1) such that implementing a PRG-HQ < 2 would not reliably address intermediate risks.

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Based on the above analysis of PRG exceedence vs. risk reduction potential, a RPRG equal to two times higher than the baseline PRG is selected. The RPRG value (13903 ng/g) was compared to the literature-based effects concentrations as a check on the degree of protection that would be afforded to aquatic biota. The RPRG concentration was found to be 1.4X higher than the NOAA ER-M (9600 ng/g dry weight (Long *et al.*, 1995)) but 1.2X less than the State of Washington Apparent Effects Threshold - Low (AET-L; 17,000ng/g) concentration (Barrick et al., 1988). Hence, the RPRG is within the range of values expected to protect aquatic biota from adverse exposures.

Total PCBs. In contrast to HMW PAHs, the PRG for Total PCBs (1638 ng/g dry wt) was exceeded only at Station DSY-27 (Figure 3.3-2). In contrast, the lack of PRG exceedences for this CoC at all other sampled locations suggests that risks due to PCBs are not widespread, and implementation of a lower PRG value is not needed. Still, this station was identified as high risk in the Marine ERA, and thus implementation of the RPRG at a PRG-HQ = 1 concentration is recommended to address risk at this location.

The RPRG concentration (1638 ng/g) is nine-fold higher than the NOAA ER-M (180 ng/g dry weight), but is intermediate between the AET-low (1000 ng/g dry) and AET-high (3100 ng/g dry) benchmarks and about 1.5X lower than the Sediment Effect Concentration of 2700 ng/g calculated by MacDonald (1994) based on a PCB-spiked sediment bioassay. Thus the RPRG is within the range of independent estimates of threshold effects levels for aquatic biota.

It is also of interest to note that the corresponding TEV value for Total PCBs was set equal to the WQC-SC value (0.03 µg/L) without site-specific modification (Table 7) such that there would appear to be a discrepancy between the level of protection afforded by water- vs. sediment-based benchmarks, with the latter being overly conservative. This is attributed to the fact that the sediment benchmarks are field-based and correlative in nature, i.e., reflective of effects caused by complex mixtures of CoCs, not PCBs acting alone. In this case, the sediment-based PCB benchmark is artificially lowered because the presence of other CoCs in the mixture which will cause the sample to be more toxic than would otherwise occur in the PCB-only case. In contrast, the WQC is based solely on PCB toxicity. Thus, the baseline PRG value, being set equivalent to the WQC-SC concentration, is expected to be completely protective of risks to aquatic biota from PCB exposure in sediment. It is also noted that the TEV value (i.e., 0.03 µg/L) is 300X less than the WQC-SA criteria (10 µg/L), and in contrast to the WQC-SA, the WQC-SC was selected for protection of birds not aquatic biota. Hence, the comparability of sediment benchmarks (ER-L/ER-M values aside) with the PRG calculated from WQC suggests that the RPRG should be adequately protective of aquatic receptors.

Overall Assessment. From the above comparison of PRG exceedences with observed risk at the site, PRG-HQs above two were observed for both high risk

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locations determined by the Marine ERA (Figure 3.2-2). Hence, adopting a RPRG of 13903 ng/g for HMW PAHs and 1638 ng/g for PCBs would ensure risk reduction at the two high risk areas for the site. A summary of areas exceeding the RPRG threshold is shown in Figure 3.3-3. Below these PRG-HQ thresholds, there was a poor correlation between the degree of risk reduction achieved by adopting lower PRG-HQ thresholds (i.e., PRG-HQ=1 for HMW PAHs) and the potentially affected area. As a result, PRG thresholds could not be discerned which could discriminate between intermediate or lower risks. Hence, adopting PRG concentrations below the recommended values would not appear supportable from a risk reduction perspective.

Resuspended Sediments. L-CoCs for resuspended sediments include arsenic, copper, lead, Total PCBs and o,p'-DDE.

Arsenic. Although TEV-HQ exceedences for arsenic were observed at two locations (DSY-38: TEV-HQ=1.01; DSY-39:TEV-HQ = 1.88), the poor proximity between the location of exceedences and lack of associated risks indicated that arsenic was a poor candidate for PRG selection. Application of the baseline PRG (24.6 μg/g) against sediment concentrations revealed PRG-HQ (Table A-10). Hence, as shown in Table 16, the implementation of a RPRG for this analyte is not recommended.

Copper. For copper, a TEV-HQ= 1.76 at Station DSY-31 was found based on a concentration of 5.1 μg/L measured in the elutriate sample. Following the methodology for PRG translation from TEVs, the PRG-HQ=1 concentration of 74 μg/g dry wt was calculated and the spatial implementation of the sediment PRG is found in Figure 3.3-4. While several stations had sediment concentrations above the PRG, a number of these locations had non-detectable elutriate Cu concentrations (e.g.,Station DSY-27 and DSY-29), such that it is clear that the predicted exceedences are erroneous. This is consistent with the fact that copper concentrations at DSY-27 and DSY-29 are not high; measured bulk concentrations were marginally above the ER-L and SEM-AVS was < 5, indicating that metals including copper are not at concentrations high enough to contribute significantly to risk. The lack of measured copper in elutriates is also consistent with the low/non-bioavailable concentrations in sediments evaluated for the ERA. Two additional URI stations (DSY-2 and DSY-3) did have Cu concentrations in sediment higher than was observed for ERA locations, but the increase was marginal (less than two-fold) and hence aquatic biota would be presumed to be at minimal risk due to Cu in resuspended sediments. Hence, the data demonstrate that copper is not a primary contributor to risk and thus retaining a PRG for remediation of sediments subject to resuspension is not recommended (Table 16).

Lead. The PRG for lead (84 μg/g dry weight) was exceeded at five stations (DSY-2, DSY-3, DSY-27, DSY-29, and DSY-32; Figure 3.3-5; Table A-10).

In the ERA exposure response relationships between benthic community (% dominant taxa) and Pb concentration in sediments suggest possible impact above about 150 μg/g (ERA Figure 6.5-1). The ordinance analysis (ERA Figure 6.5-4D) also

suggested that Pb at DSY-29 may explain the degraded conditions at this location. Hence, implementing a PRG for Pb would appear to be warranted to achieve risk reduction at this area.

In contrast to Station DSY-29, there was no evidence of Pb effects at the other high risk station (DSY-27) or any other stations from exposure-response analyses presented in the ERA. Since there was no apparent effect of Pb at DSY-27, a PRG for Pb should not be set to concentrations below that observed at DSY-27. Given that the DSY-27 (no effect) and DSY-29 concentrations are 150 and 185 μg/g, respectively, an intermediate PRG of 166 μg/g (2X baseline PRG) would appear to be adequately conservative to protect risk to aquatic biota such as was observed at DSY-29. This recommendation is consistent with the observation that tissue residues of Pb in biota at these locations are not elevated relative to reference (see ERA Figure 4.3-8 to Figure 4.3-10) .

Total PCBs. The PRG for Total PCBs (530 ng/g dry weight) was exceeded at four stations (DSY-3, DSY-11, DSY-27 and DSY-29; Figure 3.3-6). Good agreement was found between observed risk and PRG exceedence; the highest PRG-HQ (6.25) occurred at high risk Station DSY-27. Sediment PCB concentration at DSY-27 was 3310 ng/g dry wt, which is six-fold higher than the next highest surface sediment concentration (DSY-29). Reduced condition of indigenous mussels at DSY-27 was associated with increased tissue PCB concentration (ERA Figure 6.5-5), and possible PCB effects on for amphipod survival were noted (ERA Figure 6.4-2B), hence supporting the selection of Total PCBs as a PRG to address risks at this location.

Station DSY-29 was also a high risk area with a marginal PRG exceedence (PRG-HQ = 1.03). However, unlike Station DSY-27, PCBs effects at Station DSY-29 were not indicated in exposure-response analyses for amphipod survival (ERA Figure 6.4-2) or benthic community structure (ERA Figure 6.5-3D). Thus, there is a lack of supporting data to suggest that implementation of a PRG for PCBs is needed to address risks at Station DSY-29. Instead, risks are more likely related to other CoCs, notably Pb (see discussion above).

As with lead, PCB PRG thresholds below PRG-HQ < 2 could not be discerned which could discriminate between high and low risks, and thus adopting a PRG concentration below 1060 ng/g is not recommended, whereas adopting a RPRG at 1060 ng/g would conservatively ensure risk reduction in one of the high risk areas. While the RPRG is well above the NOAA ER-M (180 ng/g dry weight), the value is comparable to the State of Washington AET-low (1000 ng/g dry) and well below the AET-high (3100 ng/g dry) benchmarks. Thus the RPRG is within the range of independent estimates of protective threshold effects levels for aquatic biota.

o,p'-DDE. A single exceedence of the PRG value for o,p'-DDE (9.06 ng/g) was observed for Station DSY-27 (PRG-HQ = 7.2, Table A-10). Although this station is one of two high risk areas identified in the Marine ERA (Figure 3.2-1), the corresponding

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TEV-HQ for this station (TEV-HQ = 0.78, Table A-5) was below the presumed threshold for aquatic risks. The CoC was retained as a L-CoC only to permit a more thorough evaluation of all sediment data available, and in doing so, facilitate the detection of any locations where this CoC might be a primary risk driver to the maximum extent possible. Given that no other location contained sediment concentrations above the PRG, it is recommended that this CoC not be retained as a PRG.

Resuspension Evaluation. The ERA concluded that there exists considerable uncertainty as to whether short term risks during resuspension events would actually occur to produce exposure concentrations equivalent to 1:4 dilution used in elutriate exposures (corresponding to g/L total suspended solids concentrations). Two scenarios which have been proposed include 1) prolonged resuspension of sediments in shallow water due to severe storm events, and 2) short-term, high scouring events caused by propellor wash from large vessels during docking maneuvers. A preliminary spatial assessment of these scenarios is presented below.

Wind and wave action during storms in addition to the prevailing current are expected to have a dominant influence on patterns of sediment resuspension. These forces are expected to be particularly important for fine grained sediments which resuspend most easily and generally contain the highest bulk concentration of contaminants. Geotechnical and hydrodynamic studies of Coddington Cove conducted as part of the ERA provide insight as to the distribution of such sediments and the background currents to which they are exposed. From the analysis of cove bathymetry (ERA Figure 3.1-2), grain size distribution (ERA Figure 4.2-5) and near-bottom deposition/erosion energies (ERA Figure 4.2-17) the area of the cove most likely to contain silt/clay (< 0.8 mm diameter) sediments available for resuspension are generally restricted in water depths less than 7m (Figure 3.3-8). This zone includes bottom sediment throughout much of southern Coddington Cove, the eastern and northern portion of the cove out to 150-200 m. Resuspension of sands is also possible due to storms and/or vessel activity, however this CoC transport pathway should be considered to be of minor concern relative to fine grained sediments because of the generally lower CoC concentrations found in sandy sediments. Hence, as a rough, worst-case approximation, sediments above RPRGs within this zone could adversely effect biota depending upon the strength and duration of the resuspension event. Given the considerable uncertainties about the delineation of this zone and nature of actual resuspension conditions (location, intensity), a more detailed study of actual resuspension events are strongly recommended if concern over resuspension is the primary motivation for remedial action.

The effect of large vessel propellor turbulence as a cause of sediment resuspension (i.e., "prop scour") has been investigated by a number of authors, most recently by Maynord (1998). This USACE study was conducted to validate earlier models developed to simulate prop scour and hence predict stability of waterway channels to erosion from ship traffic. The study found good agreement between predicted and measured bottom velocity (V_b) currents for the model:

$$V_b = (C_j * V_j * D_p)/H_p \quad (8)$$

where C_j = constant for a ducted propellor, V_j = jet velocity at surface created by a docked vessel in gear at high RPM, D_p = propellor diameter, and H_p = height of propellor shaft above bottom. For Derecktor Shipyard, worst-case conditions for prop wash would appear to exist for vessel tenders that may frequently escort larger vessels into the pier. Larger vessels, such as offshore Coast Guard vessels, are presumed to only infrequently dock or may only do so with vessel tender assistance hence, as a less likely contribution to overall resuspension in the Cove. Substituting representative characteristic of vessel tenders (C_j = 0.3, D_p = 1 m) and moderately high RPM operations (V_j = 3 m sec^{-1}), and bottom currents typical for Coddington Cove (V_b = 0.1 m sec^{-1}, ERA Figure 4.2-12B), the water depth ($\sim H_p$) at which the prop wash current is no greater than the ambient current can be determined:

$$H_p = (C_j * V_j * D_p)/V_b \quad (9)$$
$$= (0.3 * 3 * 1)/0.1$$
$$= 9 \text{ m}$$

Adding 1 m for vessel draft, this result suggests that wherever the water depth in the cove is greater than 10 m, the contribution of propellor current to the bottom flow is no greater than the ambient current.

This first order approximation is translated into a prediction of bottom area potentially affected by prop wash produced by vessel tenders (Figure 3.3-8), and accordingly, potentially the resuspension of contaminated sediments above PRGs which could adversely effect biota. The map shows the 10 m bathymetry contour; bottom areas in <10 m water depth may be subject to prop wash from vessel tenders while maneuvering deeper draft vessels. It should be noted that water depth will also limit the operational area and thus the locations where prop wash scouring might occur.

The above analysis was intended to provide a conservative, yet realistic assessment of bottom areas frequently affected by prop wash. Of course, more conservative assumptions (larger vessels, higher RPM operations) would lead to potential resuspension at greater water depth. As discussed for storm resuspension, there are large uncertainties about the delineation of this zone and nature of actual resuspension conditions (location, frequency) that might occur. Finally, as noted in the ERA, it is unlikely that the intensity of resuspension would come close to the high slurry concentration represented as by 1:4 dilution used to prepare sediments for testing the toxicity of elutriates. More detailed studies of actual prop wash events are strongly recommended if concern over resuspension is used as the primary motivation for remedial action.

Overall Assessment. Based on the above information, it is recommended that sediment concentrations of 168 μg/g and 1060 ng/g respectively be adopted for lead and Total PCBs for the resuspended sediment exposure pathway since good

correspondence was observed between areas exceeding PRGs and areas of high risk. A summary of areas exceeding the RPRG threshold is shown in Figure 3.3-7. Unlike bedded sediments, however, it is difficult to independently assess the level of protection afforded by the RPRGs since benchmarks for resuspended sediments are not available. In addition, it is unclear whether the high risk areas identified in the ERA were due to exposures from bedded or resuspended sediments, or both. It is of interest to note that based on present data, areas exceeding resuspension PRGs are a subset of the total area above the bedded PRG, such that addressing bedded risks will rectify resuspension risks as presently delineated. Finally, the likelihood of resuspension does vary spatially within the cove and is dependent on the source of resuspension energy (wave action vs. ship traffic). Information on the active intensity, frequency and duration of such events will be required to effectively implement PRGs for protection of aquatic biota based solely from resuspended CoCs.

3.3.2. Avian Predator Exposure Pathway.

For the avian predator exposure pathway, five metals (arsenic, copper, lead, silver, and zinc) and Total PCBs were identified as L-CoCs and thus are included as candidate PRGs in Table 16. Sediment-based PRGs for the metals were back-calculated using the BAF-based model (Equation 5), while for Total PCBs the BSAF model was used (Equation 6).

Metals. Among the metals, sediment concentrations of arsenic did not exceed the PRG at any location (Table A-11). Copper also exceeded the PRG at two locations (Stations DSY-2 and DSY-3; Figure 3.3-9), with PRG-HQs ranging from = 1.07 to 1.43. Zinc was above the sediment PRG at 21 stations with PRG-HQs ranging from = 1.0 to 10.4 (Figure 3.3-10). Among these two CoCs, only five stations had PRG-HQs > 2 (DSY-2, DSY-3, DSY-11, DSY-27, and DSY-29). PRGs were not exceeded for the remaining metal-related L-CoCs (lead and silver).

In the Marine ERA, generally intermediate risks to avian predators were assigned to Stations DSY-28, DSY-29, and DSY-36, while slight risks were apparent elsewhere, including reference locations (SAIC, 1997; Table 6.6-3). Although there is an apparent concordance between PRG exceedence and observed risk including areas represented by Station pairs DSY-2/DSY-28 and DSY-3/DSY-29, implementation of remedial action based on this PRG does not appear warranted given the limitation of the conservative exposure assumptions in the ERA and subsequent conclusion that CoCs in Coddington Cove do not likely pose an unacceptable risk to avian receptors (ERA Section 6.3). Thus, despite the fact that PRGs were exceeded, the avian predator would have to spend its entire life feeding in the affected area for true risks to occur. This overly conservative assumption leads to the recommendation that the PRGs for risk reduction for the avian aquatic exposure pathway metals not be adopted at this time except perhaps for purposes of monitoring to ensure continued lack of significant risks via food chain transfer from prey species to aquatic predators.

Total PCBs. PRGs for Total PCBs were exceeded at 24 stations (Table A-11; Figure 3.3-11), with PRG-HQs ranging from 1.0 (Station DSY-21) to 35.7 (Station DSY-27). Among these locations, only four stations exhibited PRG-HQs > 5 (DSY-3, DSY-11, DSY-27, and DSY-29). As noted above for metals, intermediate risks were assigned to avian predators feeding at Stations DSY-28, DSY-29, and DSY-36. The agreement between PRG exceedence and observed risk included areas represented by Station pairs DSY-28 (PRG-HQ=1.45, Table A-11A and A-11B) and particularly DSY-29 (PRG-HQ=35.9), might ordinarily suggest implementation of remedial action, but because of the conservative exposure assumptions unacceptable risk to avian receptors due to PCB exposure is unlikely.

An additional consideration for the indirect effects that PCBs might have on avian predators through reduction in the supply food from PCB-sensitive species. The maximum predicted porewater concentration of PCBs was found at Station DSY-27 (0.027 µg/L) is slightly below the USEPA WQC-SC value (0.03 µg/L), but is nearly 1500-fold lower than the measured Aroclor-1254 LC_{50} for the amphipod, *Ampelisca abdita* (40 µg/L; Ho et al., 1997) used in the ERA and found to exhibit slight toxicity when exposed to sediments from this location. Hence it is unlikely that PCBs in Derecktor Shipyard/Coddington Cove would impact avian predators through reduction in their food supply. Thus, as shown in Table 16, a PRG for Total PCBs to protect the avian predator exposure pathway is not recommended for implementation.

3.3.3. Human Health Exposure Pathway.

The L-CoCs identified for protection of risks to subsistence fishermen from consumption of shellfish were arsenic and benzo(a)pyrene (Table 16). Baseline PRGs presented in Table 16 represent threshold concentrations for protection of carcinogenic effects at 1×10^{-6} risk and non-carcinogenic risks at HQ=1. However, there is a high probability that the exposure scenario is overly conservative (a subsistent fisherman is not likely to derive all seafood exclusively from Coddington Cove for 30+ years, nor could the cove support such intensive pressure from a subsistence population). Perhaps a more plausable (yet conservative) assumption is that the shellfishing population might rely on the cove for up to 10% of the amounts noted in Table 10, such that 10 times the PRG-HQ threshold is a realistic point of departure for assumption of possible adverse health effects due to shellfish consumption. With this assumption in mind, the PRGs were evaluated below at PRG-HQ = 1 and at 10 times the PRG-HQ thresholds.

Arsenic. Arsenic was identified as a L-CoC for protection of risks to human health exposure from consumption of shellfish (Table 16). While arsenic concentrations marginally exceeded the TEV (TEV-HQ < 2, Appendix Table A-7), the corresponding PRG-HQs were all less than unity (Appendix Table A-12). This discrepancy is attributed in part to uncertainty in the BAF factor for arsenic used to calculate the sediment PRG (19.7 µg/g) from the tissue-based TEV value. However, any overlooked risk because of the BAF limitation would appear to be outweighed by

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the fact that the true risk to arsenic may be overestimated by an order of magnitude since the toxic fraction (i.e., the organic component) is typically about 10% of the total arsenic content (USFDA, 1993). Further, a review of the literature regarding the methodology used to derive the TRV value (extrapolated from mice), reveals that the route of exposure evaluated was arsenic in drinking water, and since arsenic was administered in soluble form, it is likely to be far more bioavailable than arsenic bound to sediment particles. Finally, arsenic risks are unlikely to be significant as all areas of the cove had sediment concentrations well below the baseline PRG.

Based on the above data, it is recommended that an arsenic value not be selected as a Final Remediation Goal, but monitoring for organic arsenic concentrations should be performed at least once to confirm that bioavailable concentrations are below toxic levels. Revision of the PRG list could occur pending outcome of the monitoring results.

Benzo(a)pyrene. Benzo(a)pyrene was also identified as a L-CoC for protection of risks from consumption of shellfish (Table 16). The sediment-based PRG concentration at PRG-HQ=1 (53.9 ng/g dry wt) was exceeded at 34 of 41 stations (Appendix Table A-12; Figure 3.3-12). The areas with highest PRG-HQs (HQs > 10) were confined to the nearshore areas including Stations DSY-2, DSY-3, DSY-18, DSY-20, DSY-27, DSY-29, and DSY-30. Much of the area exceeding the PRG-HQ=10 threshold are not fishable due to industrial/military activity in the shipyard/cove (approximately all areas between and eastward of the piers and dock areas shown in Figure 3.3-12). Perhaps the area represented by polygons around Stations DSY-18 and DSY-30 may be fishable and PRGs could be implemented in some manner to guard against adverse risk from shellfish consumption. It is recommended that the 10 X PRG concentration (535 ng/g dry weight) be adopted given the conservative nature of the subsistence fishermen scenario, but a careful cost/benefit analysis (including more detailed delineation of the affected area) should be conducted to weigh the advantages of risk reduction against the disruptive nature of remediation.

Summary. A summary of areas exceeding the RPRG for benzo(a)pyrene (539 ng/g dry weight) threshold is shown in Figure 3.3-13. Based on present data, it is unlikely that the shellfishing population is substantially at risk since fishable areas above RPRG concentrations are limited and would not be expected to support a subsistence fishing population. However, it would seem reasonable to monitor for this CoC to confirm that harvested shellfish remain below toxic levels.

4. CONCLUSIONS/RECOMMENDATIONS

The PRG development strategy for the Derecktor Shipyard/ Coddington Cove study area was developed in a manner consistent with site ARARs and has identified RPRGs that are consistent with the findings of the risk assessments. The magnitudes of the PRGs are generally comparable to correlative benchmarks which increases the

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certainty that minimal residual risk associated with the CoCs will remain when the PRGs are implemented.

The RPRG concentrations identified in Table 16 for aquatic, avian, and human health exposure pathway are listed for consideration as Final Remediation Goals (pending further evaluation in the FS). These values may differ from concentrations assumed to represent the baseline risk condition (i.e., PRG-HQ=1) because of the need to ensure that the PRG implementation leads to effective and practical risk reduction; selecting all PRGs or remediating to baseline concentrations would affect nearly all of Coddington Cove (light and densely shaded areas of Figure 3.3-14; Table A-13), and thus does not appear to provide an optimal balance between the degree of risk reduction achieved and potential environmental impacts that would occur on adjacent areas during the remediation process. In contrast, the RPRG concentrations are based on interpretation of the data in light of observed distribution and severity of estimated risks at the site; high and some intermediate risk areas are addressed (densely shaded areas noted B or R in Figure 3.3-14), while simultaneously, a number of areas above RPRG concentrations for human health are also included (densely shaded areas noted H in Figure 3.3-14). Other considerations presented in FS report regarding cost and engineering constraints may also modify the Final Remediation Goals to be adopted by risk managers.

Depending on the nature of the remedial action, a PRG list based on a combined pathway analysis may be suitable. It is acknowledged that the spatial resolution of the analysis depends on the density of stations within the study area. Some areas which might require remedial action may presently be depicted larger than they actually are, and thus will require confirmation sampling during the pre-design investigation in order to reduce uncertainty and to better define the extent of the areas to be remediated.

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Figure 2.2-1. Water quality screening value selection process and associated data qualifiers.
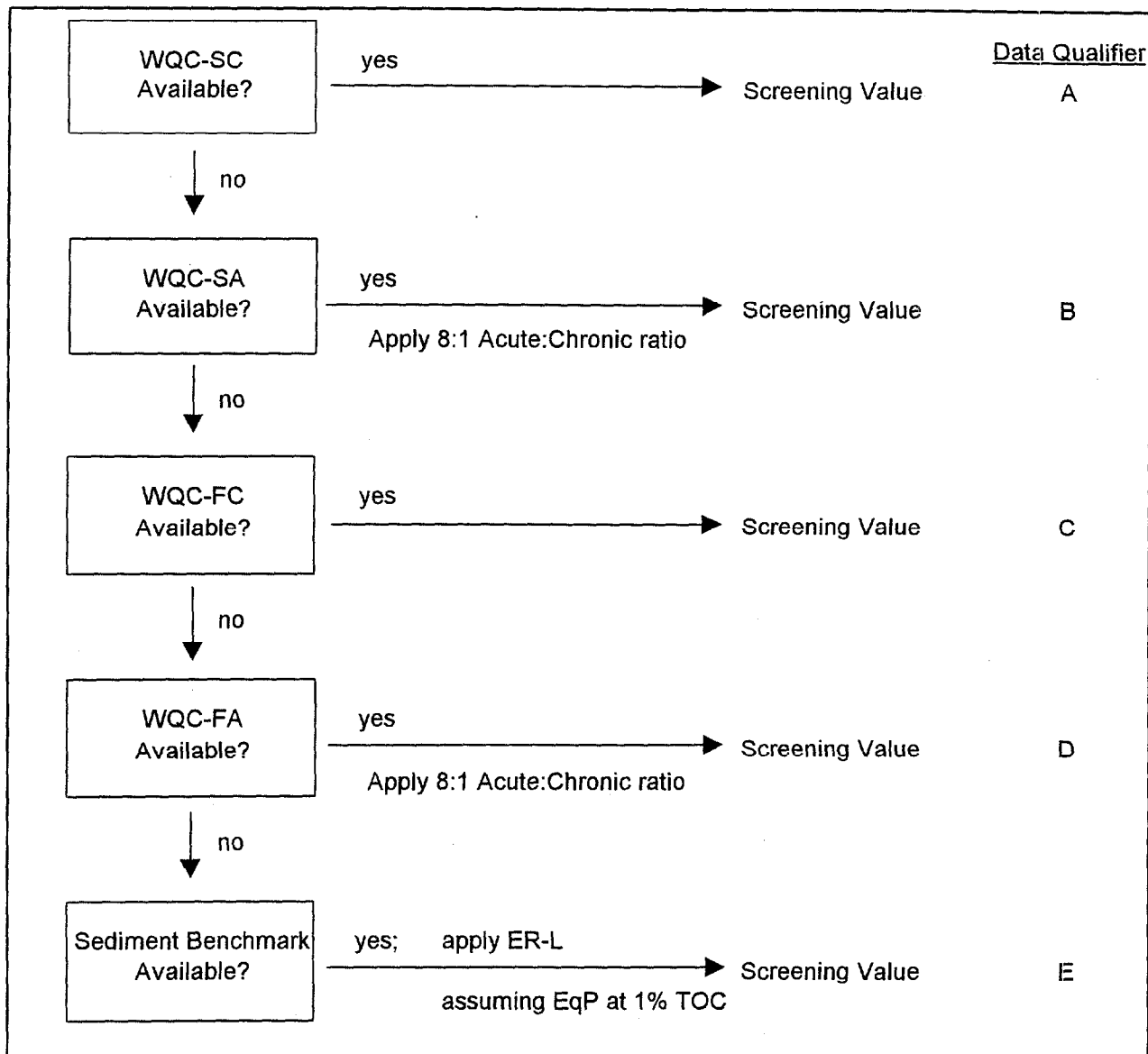
Figure 3.2-1. Thiessen polygons for PRG implementation for the Derecktor Shipyard/
Coddington Cove study area.
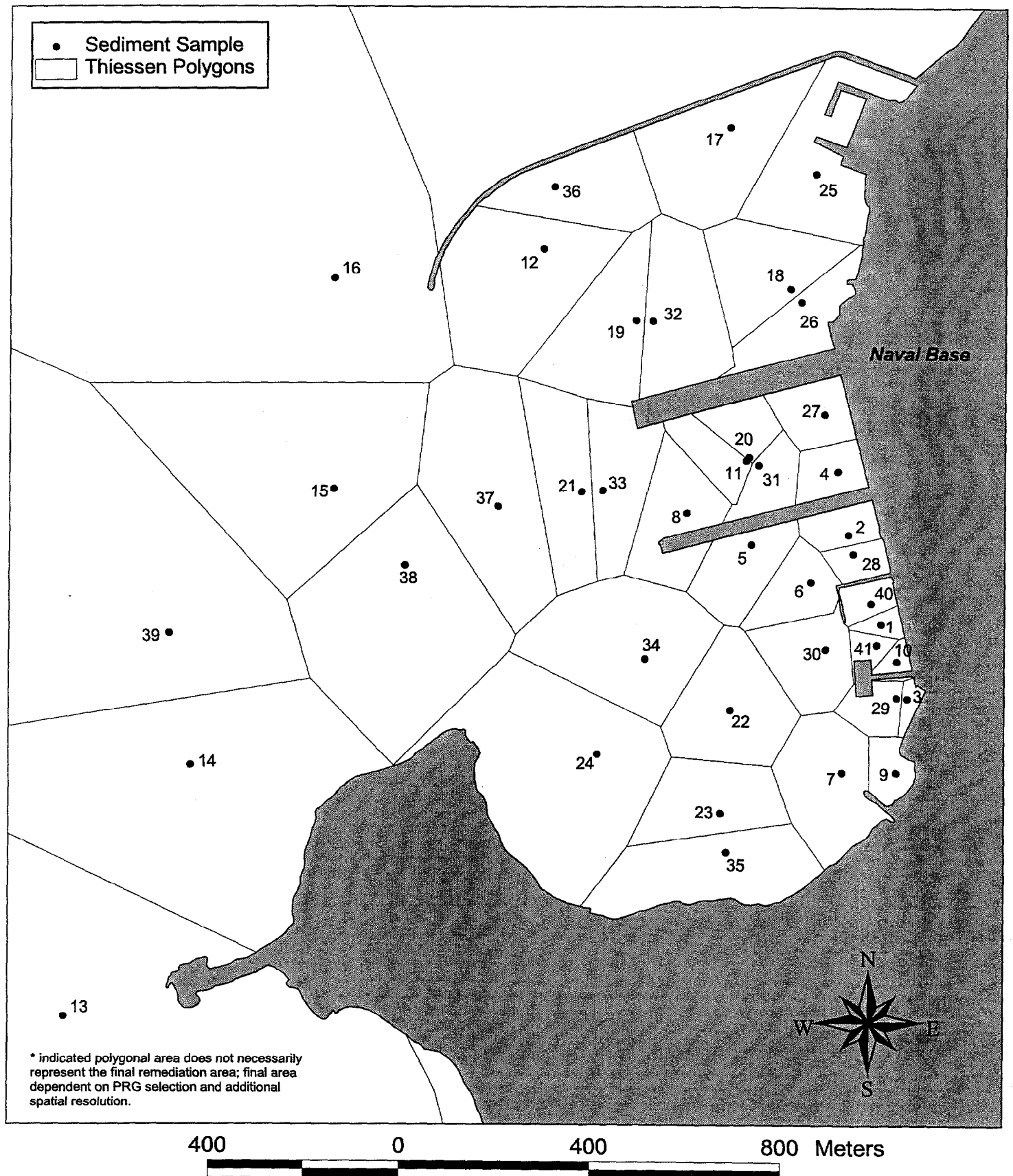
Figure 3.2-2. Risk probability for the Derecktor Shipyard/Coddington Cove study area.

Legend:
- • Sediment Sample
- Risk Probability
  - +
  - ++
  - +++
  - Data not evaluated for risk probability

Naval Base

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* indicated polygonal area does not necessarily represent the final remediation area; final area dependent on PRG selection and additional spatial resolution.

400   0   400   800 Meters
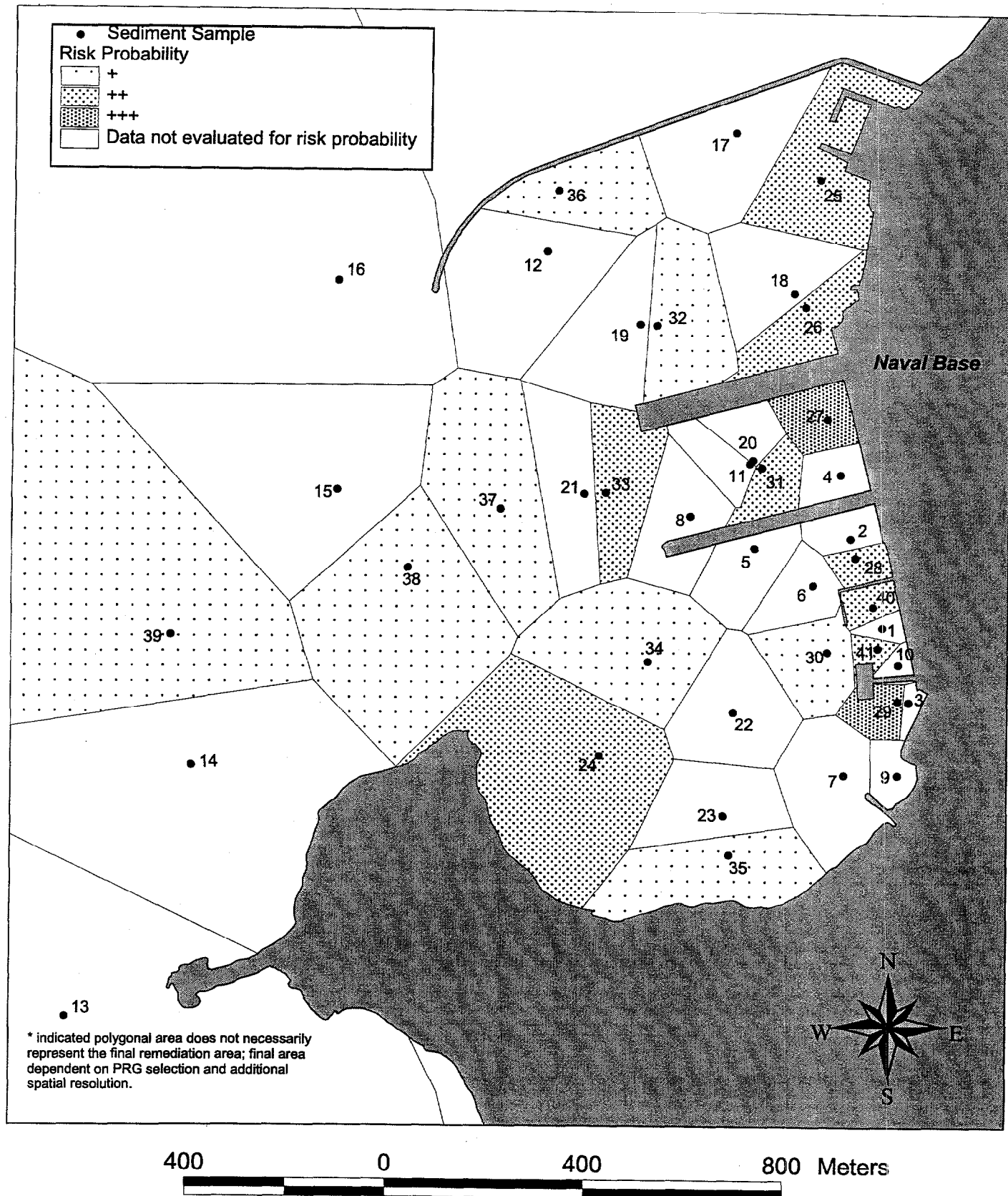
Figure 3.3-1. Summary of CoCs exceeding PRGs for protection of aquatic biota by location for sediments in the Derecktor Shipyard/Coddington Cove study area:*

Bedded Sediment Exposure Pathway for HMW PAHs

Legend:
- Sediment Sample
- Thiessen Polygons

PRG-HQs
- < 1
- 1- 2
- > 2

Bedded HMW PAHs
DSY-2:   9.24
DSY-3:   10.54
DSY-18: 1.86
DSY-19: 1.33
DSY-20: 2.95
DSY-27: 1.47
DSY-29: 4.35
DSY-30: 1.49

Naval Base

* indicated polygonal area does not necessarily represent the final remediation area; final area dependent on PRG selection and additional spatial resolution.

400   0   400   800 Meters
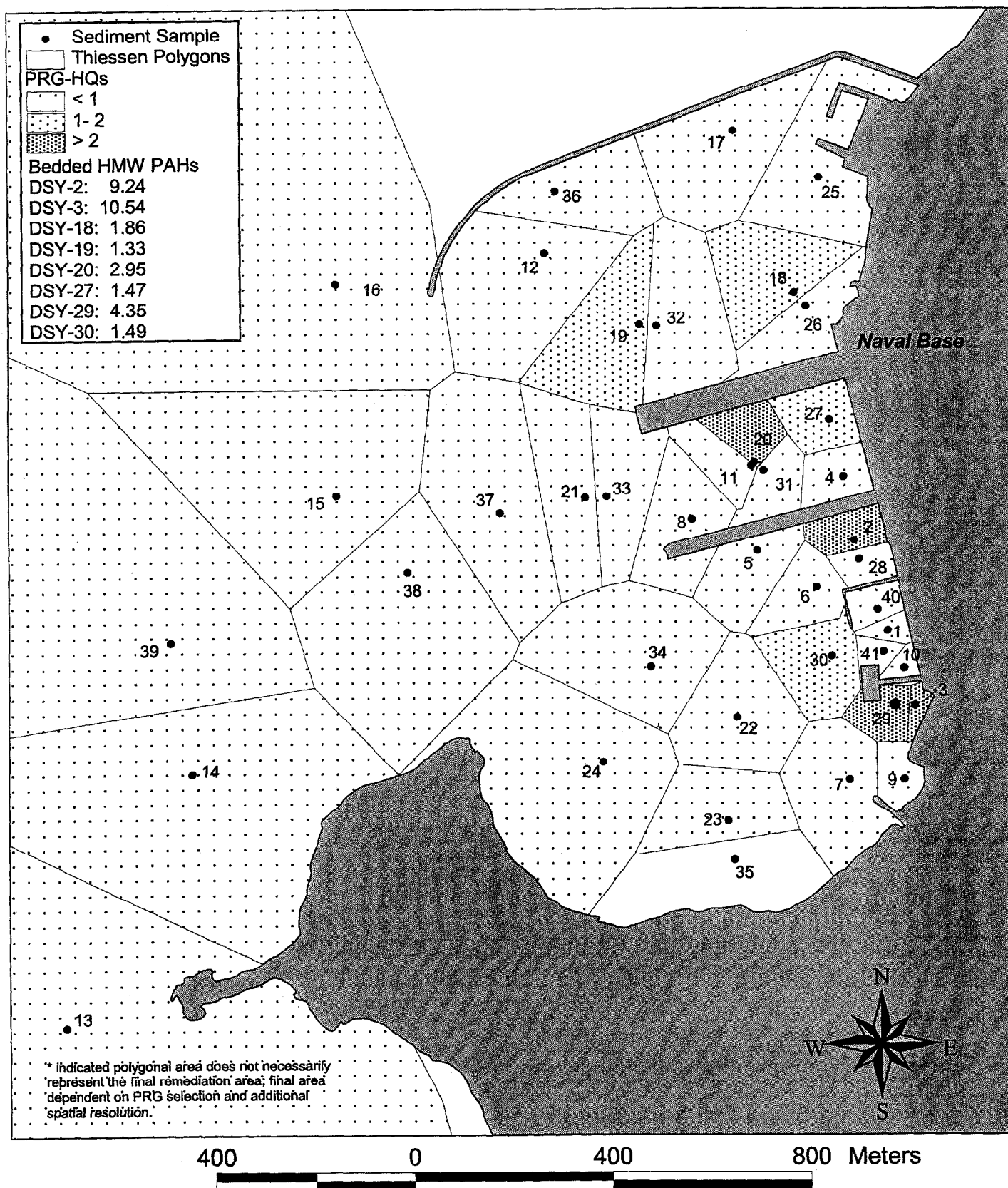
Figure 3.3-2. Summary of CoCs exceeding PRGs for protection of aquatic biota by location for sediments from the Derecktor Shipyard/Coddington Cove study area:*
Bedded Sediment Exposure Pathway for Total PCBs

Legend:
- Sediment Sample
- Thiessen Polygons
- PRG-HQ
  - < 1
  - 1 - 2
  - > 2
- Bedded Total PCBs
- DSY-27: 2.02

Naval Base

* indicated polygonal area does not necessarily represent the final remediation area; final area dependent on PRG selection and additional spatial resolution.

400   0   400   800 Meters
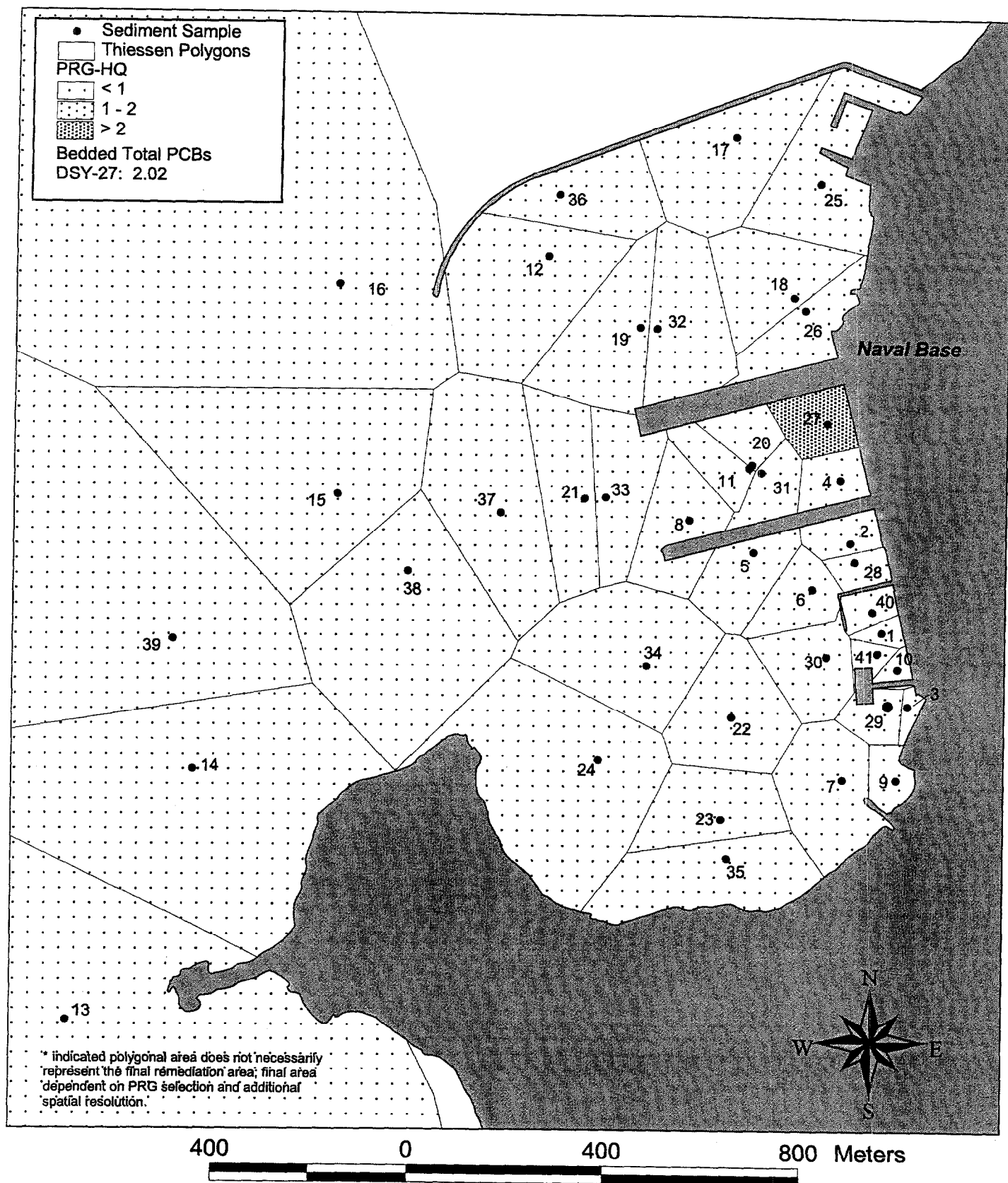
Figure 3.3-3. Summary of CoCs exceeding aquatic PRGs by location for sediments from the Derecktor Shipyard/Coddington Cove study area:*

Recommended PRG Implementation for the Bedded Sediment Exposure Pathway

Legend:
- • Sediment Sample
- ▢ Thiessen Polygons
- ▨ Rec. PRG (RPRG) Exceeded

HMW PAHs (RPRG = 13903 ng/g)
DSY-2:   63994 ng/g
DSY-3:   72956 ng/g
DSY-20:   20406 ng/g
DSY-29:   30118 ng/g

Total PCBs (RPRG = 1638 ng/g)
DSY-27: 3310 ng/g

Naval Base

* indicated polygonal area does not necessarily represent the final remediation area; final area dependent on PRG selection and additional spatial resolution.

400   0   400   800 Meters
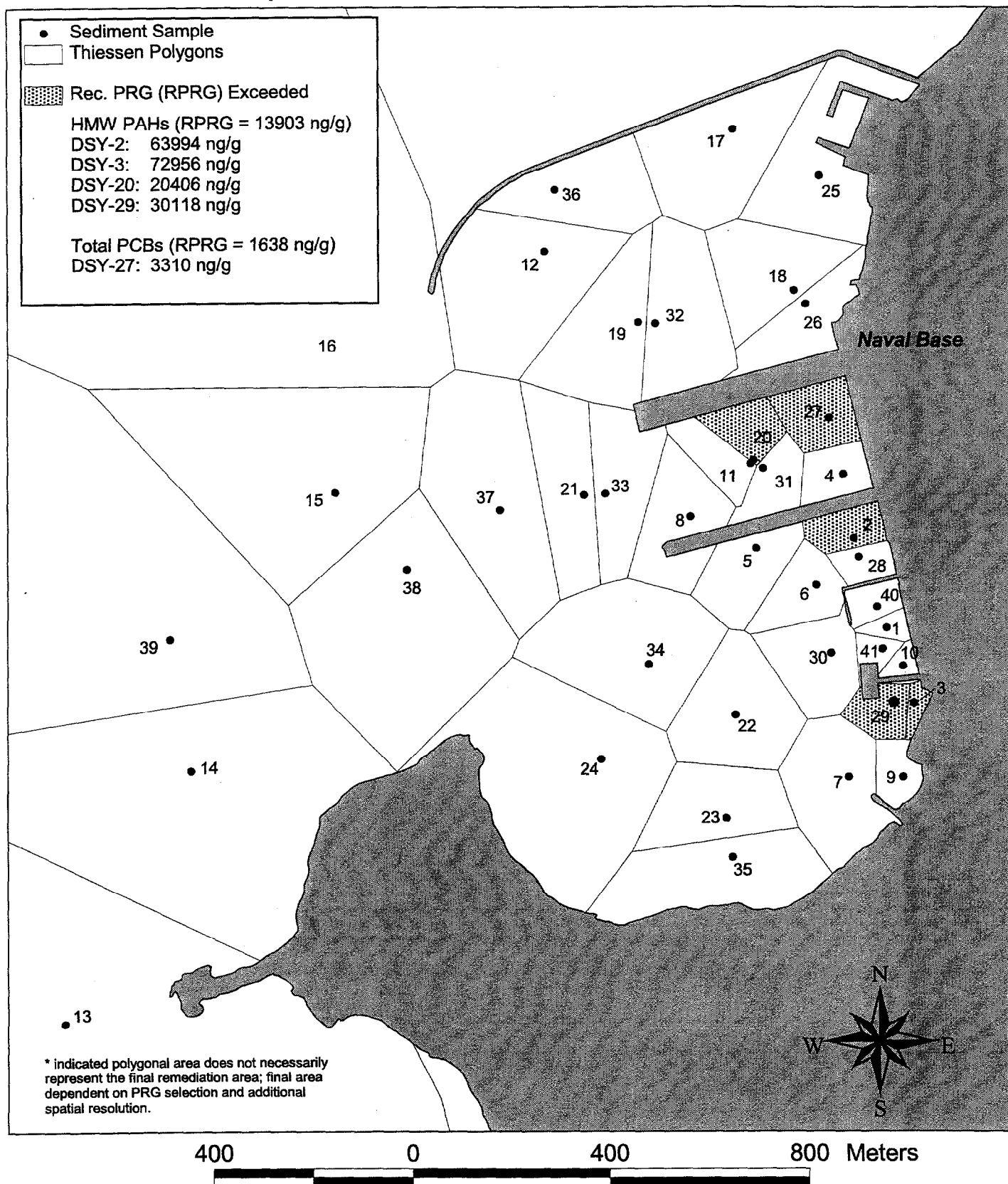
Figure 3.3-4. Summary of CoCs exceeding PRGs for protection of aquatic biota by location for sediments from the Derecktor Shipyard/Coddington Cove study area:*

Resuspended Sediment Exposure Pathway for Copper

Legend:
- Sediment Sample
- Thiessen Polygons

PRG-HQs
- <1
- 1 - 2
- > 2

Resuspended Copper
DSY-2: 2.67
DSY-3: 3.56
DSY-8: 1.03
DSY-11: 1.10
DSY-18: 1.11
DSY-20: 1.08
DSY-27: 2.25
DSY-29: 2.14
DSY-30: 1.10
DSY-31: 1.10

Naval Base

*. indicated polygonal area does not necessarily represent the final remediation area; final area dependent on PRG selection and additional spatial resolution.

400   0   400   800 Meters
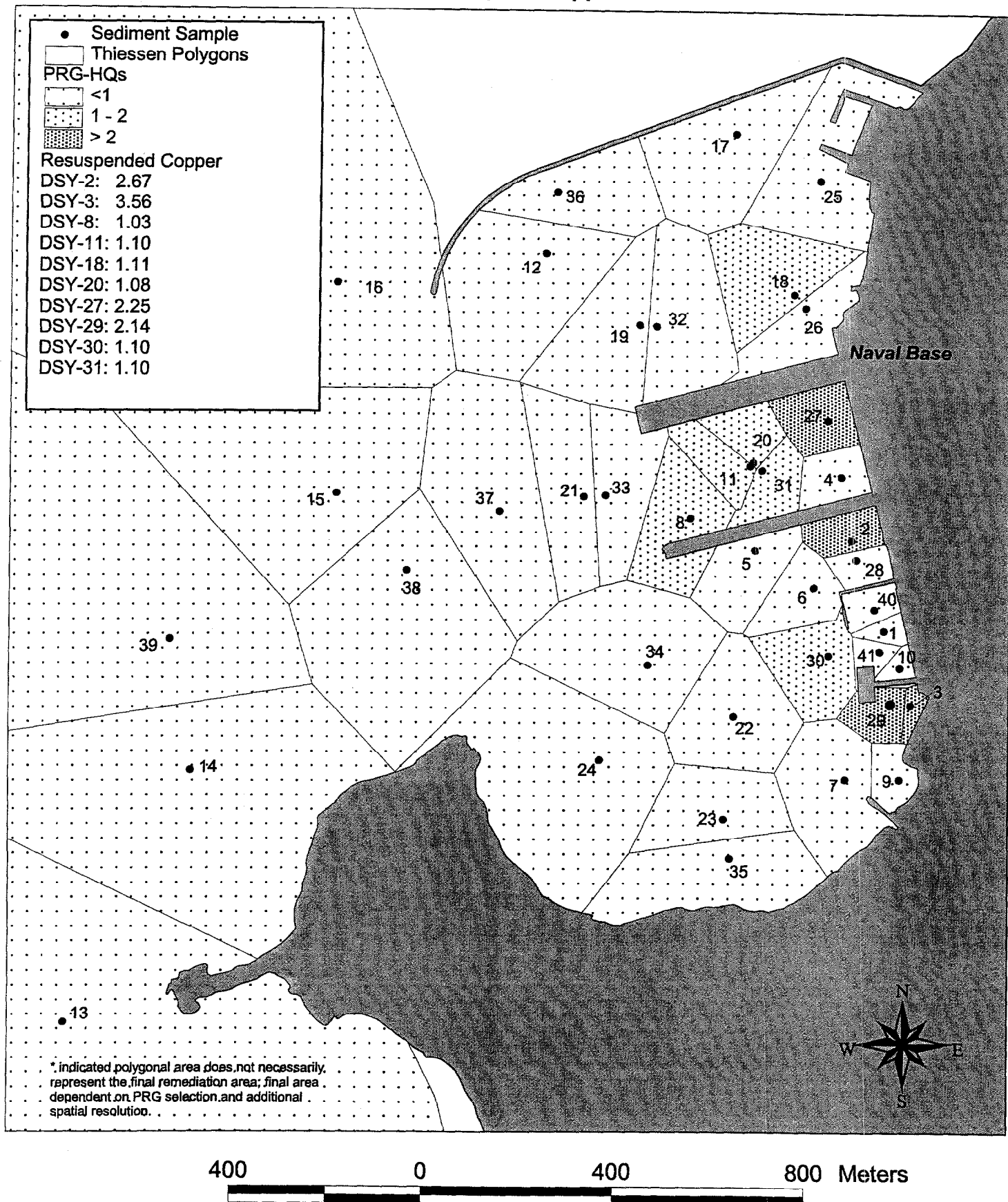
Figure 3.3-5. Summary of CoCs exceeding PRGs for protection of aquatic biota by location for sediments from the Derecktor Shipyard/Coddington Cove study area:*

Resuspended Sediment Exposure Pathway for Lead

Legend:
- • Sediment Sample
- ▫ Thiessen Polygons

PRG-HQs
- < 1
- 1 - 2
- > 2

Resuspended Lead
- DSY-2: 2.15
- DSY-3: 2.40
- DSY-27: 1.80
- DSY-29: 2.21
- DSY-32: 1.49

Naval Base

*. indicated polygonal area does not necessarily represent the final remediation area; final area dependent on PRG selection and additional spatial resolution.

400   0   400   800 Meters
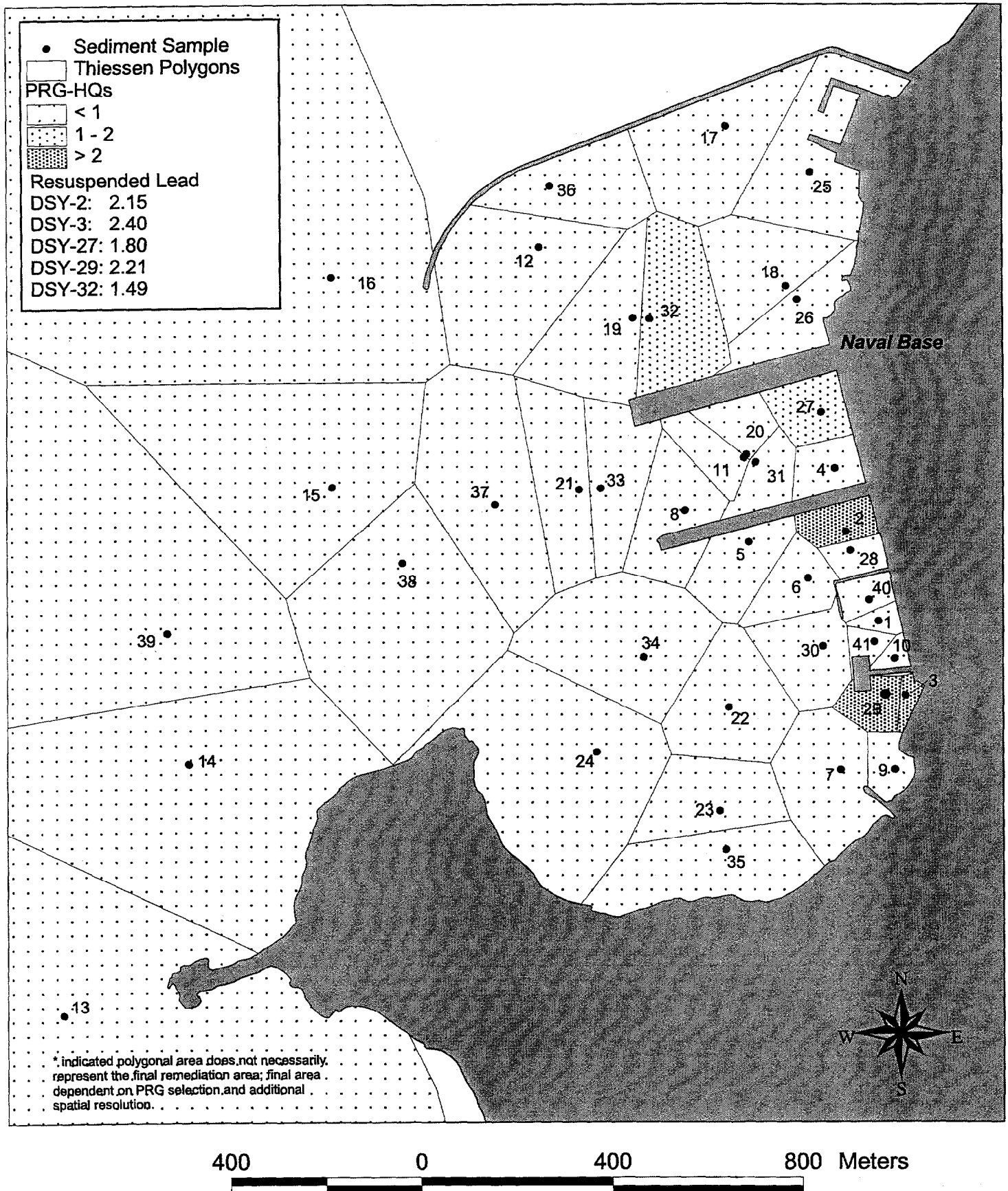
Figure 3.3-6. Summary of CoCs exceeding PRGs for protection of aquatic biota by location for sediments from the Derecktor Shipyard/Coddington Cove study area:*

Resuspended Sediment Exposure Pathway for Total PCBs

Legend:
- ● Sediment Sample
- Thiessen Polygons

PRG-HQs
- < 1
- 1 - 2
- > 2

Resuspended Total PCBs
DSY-3: 1.38
DSY-11: 1.24
DSY-27: 6.25
DSY-29: 1.03

Naval Base

*. indicated polygonal area does not necessarily represent the final remediation area; final area dependent on PRG selection and additional spatial resolution.

400   0   400   800 Meters
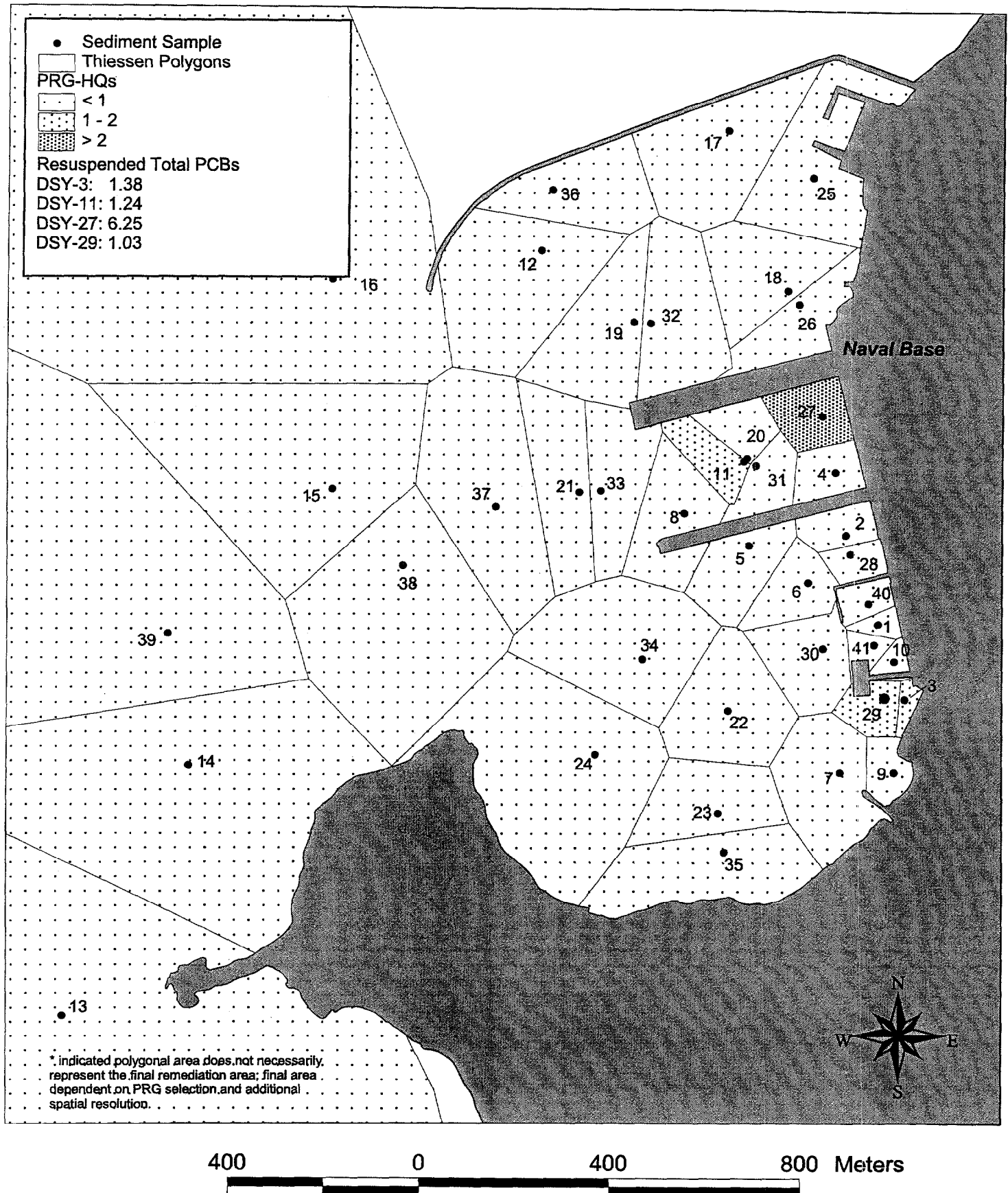
Figure 3.3-7. Summary of CoCs exceeding aquatic PRGs by location for sediments from the Derecktor Shipyard/Coddington Cove study area:*

Recommended PRG Implementation for the Resuspended Sediment Exposure Pathway

Legend:
- Sediment Sample
- Thiessen Polygons
- Rec. PRG (RPRG) Exceeded

Lead (RPRG = 167.9 ug/g)
DSY-2:   181 ug/g
DSY-3:   201 ug/g
DSY-29: 186 ug/g

Total PCBs (RPRG = 1060 ng/g)
DSY-27: 3310 ng/g

Naval Base

* indicated polygonal area does not necessarily represent the final remediation area; final area dependent on PRG selection and additional spatial resolution.

400   0   400   800 Meters
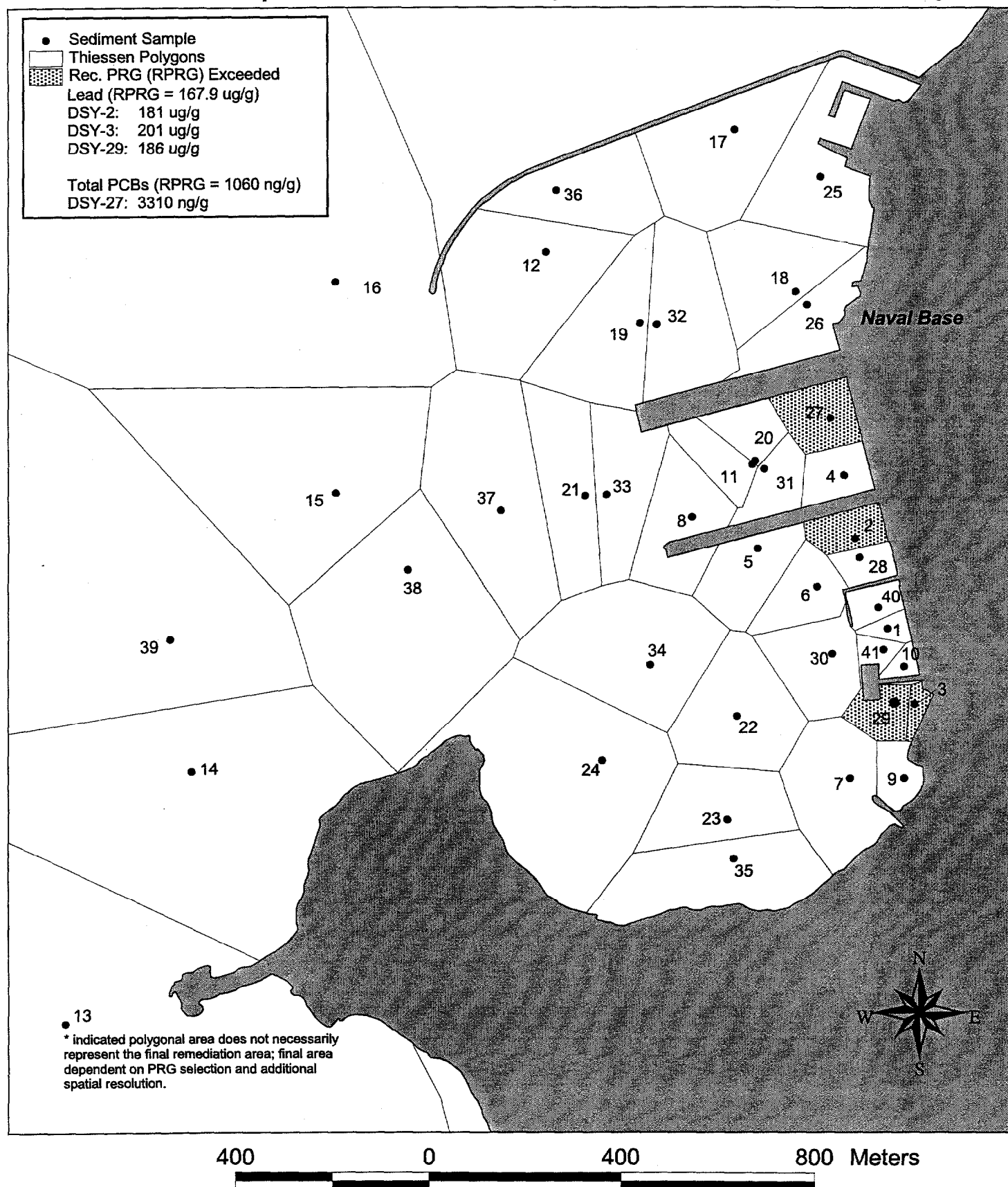
Figure 3.3-8. Bathymetry of Coddington Cove, NETC Newport, RI and the inferred zone of potential sediment resuspension.
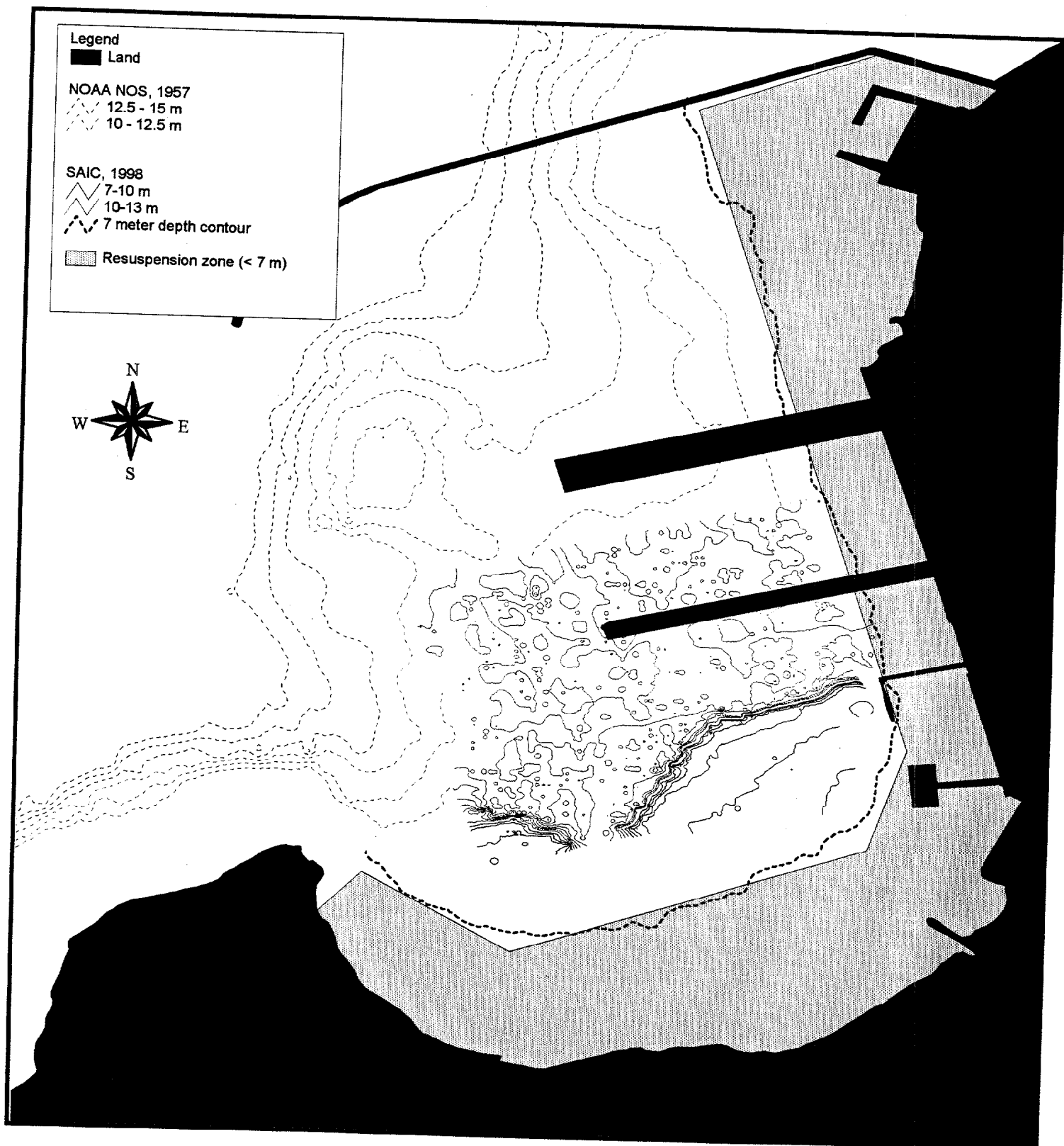
Figure 3.3-9. Summary of CoCs exceeding PRGs for protection of avian predators by location for sediments from the Derecktor Shipyard/Coddington Cove study area:*

Avian Predator Exposure Pathway for Copper

Legend:
- Sediment Sample
- Thiessen Polygons

PRG-HQs
- <1
- 1-2
- >2

Copper
DSY-2: 1.07
DSY-3: 1.43

Naval Base

* indicated polygonal area does not necessarily represent the final remediation area; final area dependent on PRG selection and additional spatial resolution.

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400   0   400   800 Meters
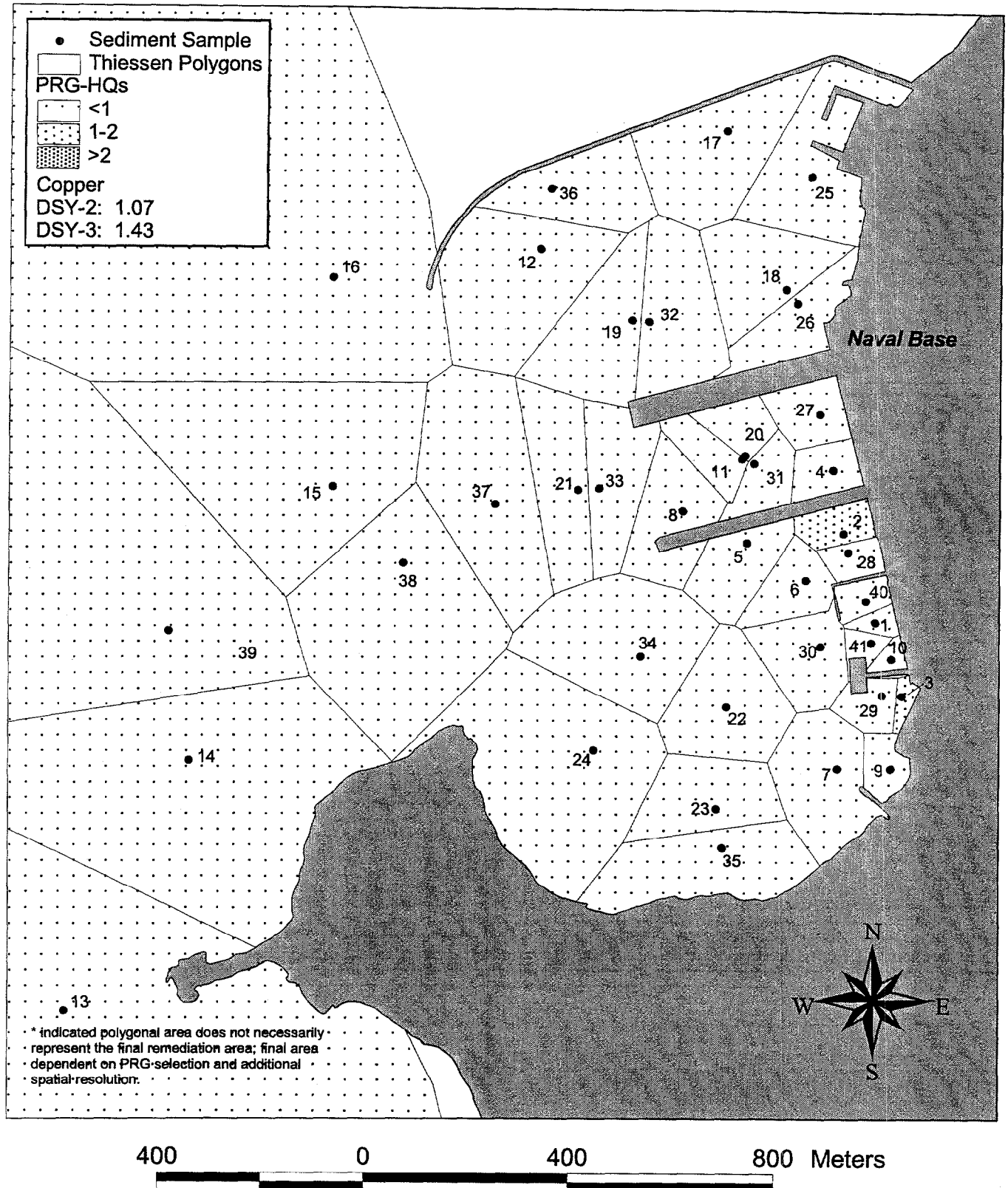
Figure 3.3-10. Summary of CoCs exceeding PRGs for protection of avian predators by location for sediments from the Derecktor Shipyard/Coddington Cove study area:*

Avian Predator Exposure Pathway for Zinc

Legend:
- ● Sediment Sample
- □ Thiessen Polygons

PRG-HQs
- <1
- 1-2
- >2

Zinc
DSY-1: 1.27
DSY-2: 5.04
DSY-3: 10.47
DYS-4: 1.61
DSY-5: 1.47
DSY-6: 1.49
DSY-7: 1.01
DSY-8: 1.57
DSY-11: 9.39
DSY-12: 1.37
DSY-18: 1.39
DSY-19: 1.19
DSY-20: 1.34
DSY-21: 1.49
DSY-22: 1.21
DSY-23: 1.19
DSY-27: 4.65
DSY-28: 1.44
DSY-29: 3.34
DSY-30: 1.64
DSY-31: 1.42
DSY-32: 1.71
DSY-36: 1.27

* indicated polygonal area does not necessarily represent the final remediation area; final area dependent on PRG selection and additional spatial resolution.

400   0   400   800 Meters

Figure 3.3-11. Summary of CoCs exceeding PRGs for protection of avian predators by location for sediments from the Derecktor Shipyard/Coddington Cove study area:*

Avian Predator Exposure Pathway for Total PCBs

Legend:
- • Sediment Sample
- ☐ Thiessen Polygons

PRG-HQs
- <1
- 1-2
- >2

Total PCBs
DSY-1:	2.27
DSY-3:	7.96
DYS-4:	2.11
DSY-5:	1.14
DSY-6:	1.43
DSY-8:	1.61
DSY-11:	7.14
DSY-12:	1.91
DYS-17:	2.65
DSY-18:	3.18
DSY-19:	2.35
DSY-20:	3.98
DSY-21:	1.00
DSY-22:	1.93
DSY-23:	1.63
DSY-25:	1.02
DYS-26:	1.07
DSY-27:	35.92
DSY-28:	1.45
DSY-29:	5.93
DSY-30:	3.42
DSY-31:	2.40
DSY-32:	2.18
DSY-36:	1.23
DSY-37:	1.08

Naval Base

* indicated polygonal area does not necessarily represent the final remediation area; final area dependent on PRG selection and additional spatial resolution.

400   0   400   800 Meters
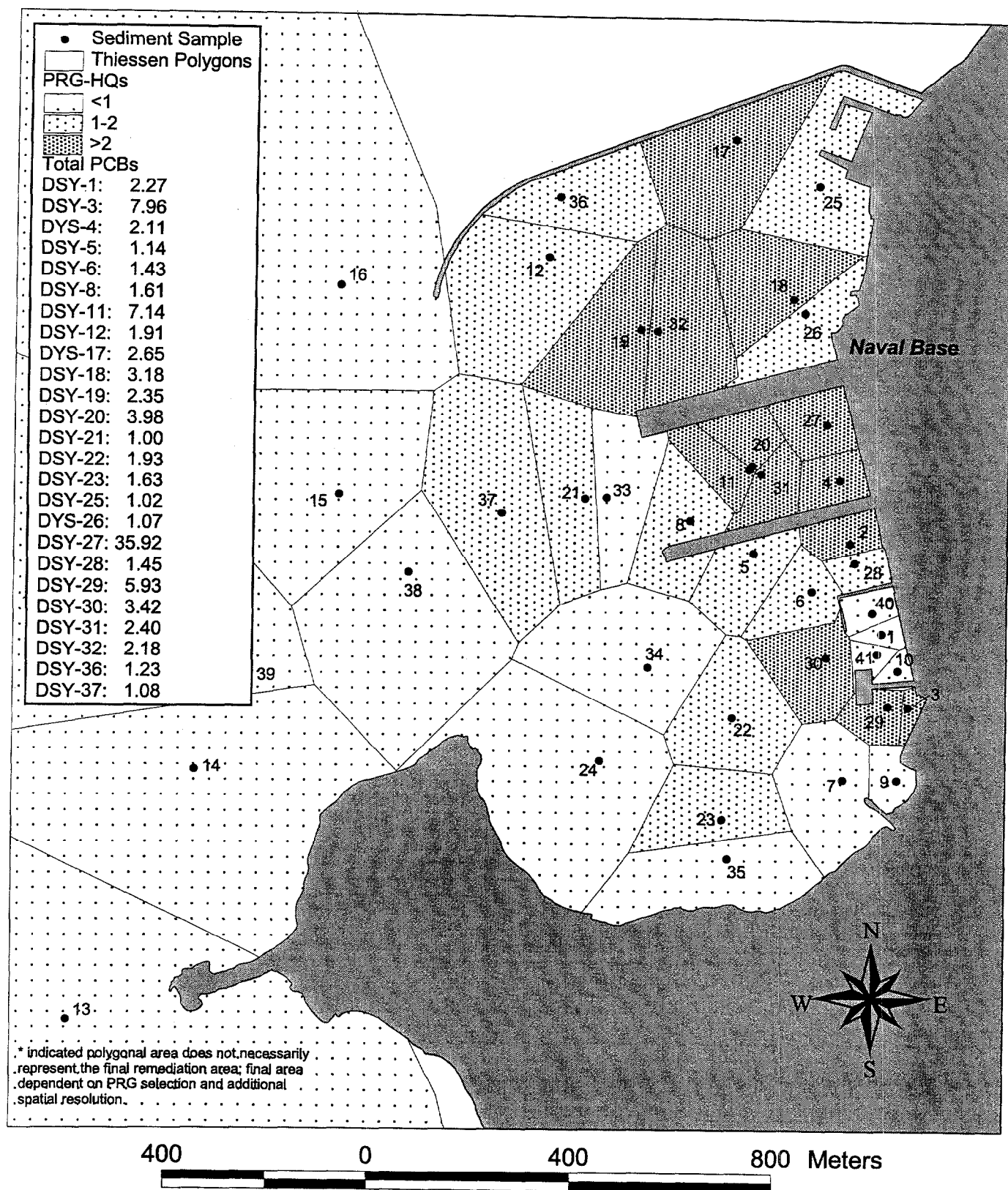
Figure 3.3-12. Summary of CoCs exceeding PRGs for protection of human health by location for sediments from the Derecktor Shipyard/Coddington Cove study area:*

Human Health Exposure Pathway for Benzo(a)pyrene

- Sediment Sample
Thiessen Polygons
Benzo(a)pyrene PRG-HQ
<1
1 - 10
>10

Benzo(a)pyrene
DSY-1:   3.06
DSY-2: 62.02
DSY-3: 87.98
DSY-4:   8.06
DSY-5:   7.51
DSY-6:   9.12
DSY-7:   5.64
DSY-8:   8.98
DSY-11: 3.85
DSY-12: 4.65
DSY-15: 4.58
DSY-17: 5.80
DSY-18: 22.23
DSY-19: 9.27
DSY-20: 16.44
DSY-21: 2.05
DSY-22: 3.40
DSY-23: 4.47
DSY-24: 1.02
DSY-25: 7.39
DSY-26: 8.11
DSY-27: 17.26
DSY-28: 7.05
DSY-29: 44.46
DSY-30: 15.16
DSY-31: 7.86
DSY-32: 9.24
DSY-33: 1.27
DSY-34: 2.76
DSY-36: 5.97
DSY-37: 3.06
DSY-38: 2.24
DSY-39: 2.67
DSY-40: 5.91

Naval Base

* indicated polygonal area does not necessarily represent the final remediation area; final area dependent on PRG selection and additional spatial resolution.

400   0   400   800 Meters

Figure 3.3-13. Summary of CoCs exceeding human health PRGs by location for sediments from the Derecktor Shipyard/Coddington Cove study area:*

Recommended PRG Implementation for the Human Health Exposure Pathway

Legend:
- Sediment Sample
- Thiessen Polygons
- Rec. PRG (RPRG) Exceeded

Benzo(a)pyrene (RPRG = 539 ng/g)
DSY-2:   3320 ng/g
DSY-3:   4710 ng/g
DSY-18: 1190 ng/g
DSY-20: 880 ng/g
DSY-27: 924 ng/g
DSY-29: 2380 ng/g
DSY-30: 812 ng/g

Naval Base

* indicated polygonal area does not necessarily represent the final remediation area; final area dependent on PRG selection and additional spatial resolution.

400   0   400   800 Meters
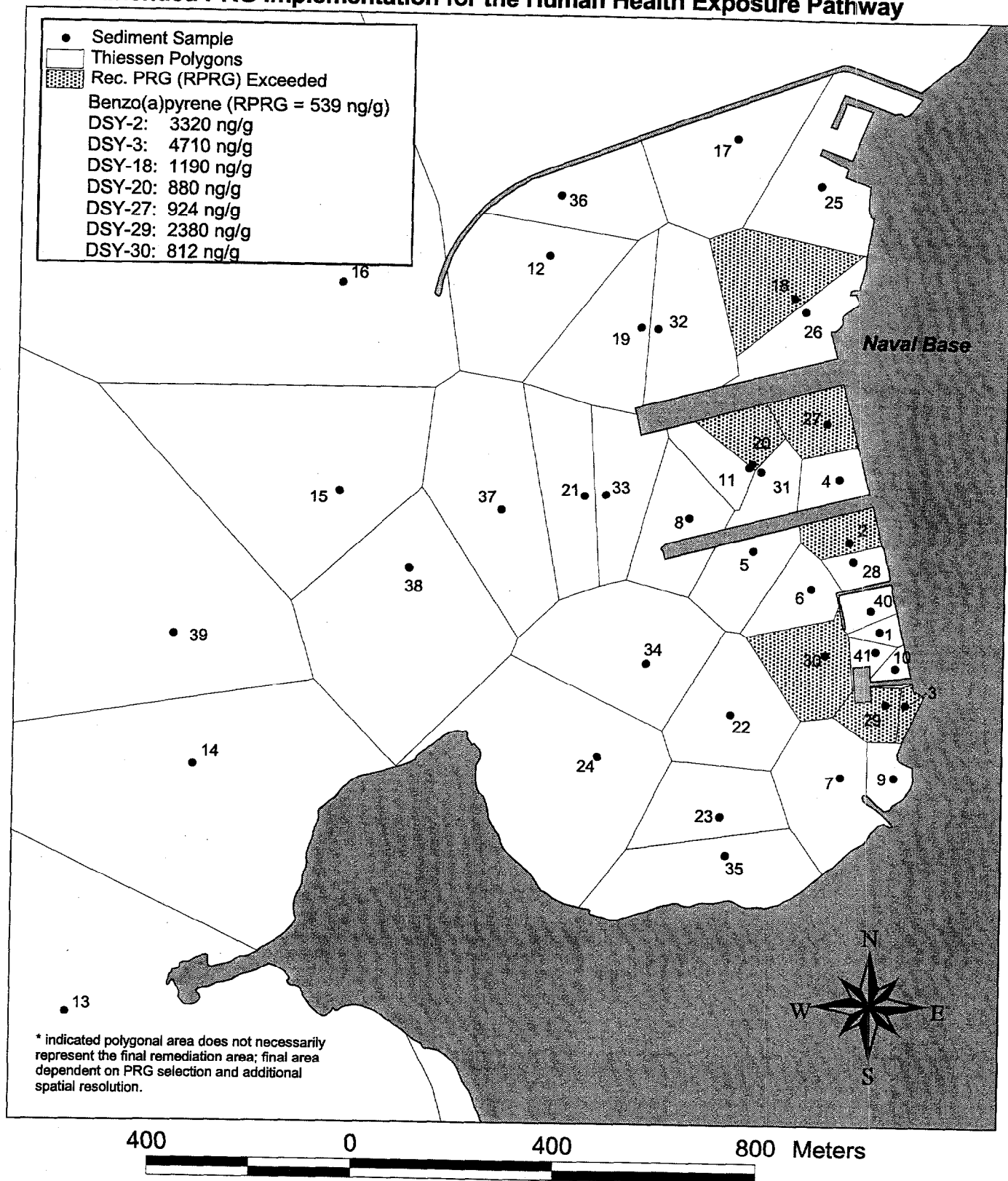
Figure 3.3-14. Summary of PRG exceedences by pathway for Derecktor Shipyard/Coddington Cove study area.

Legend:
- Sediment Sample
- Thiessen Polygons
  - <PRG
  - >Baseline PRG, <Rec PRG
  - >Rec PRG

B = Aquatic Bedded
R = Aquatic Resuspended
H = Human Health
A = Avian

* indicated polygonal area does not necessarily represent the final remediation area; final area dependent on PRG selection and additional spatial resolution.

400   0   400   800 Meters
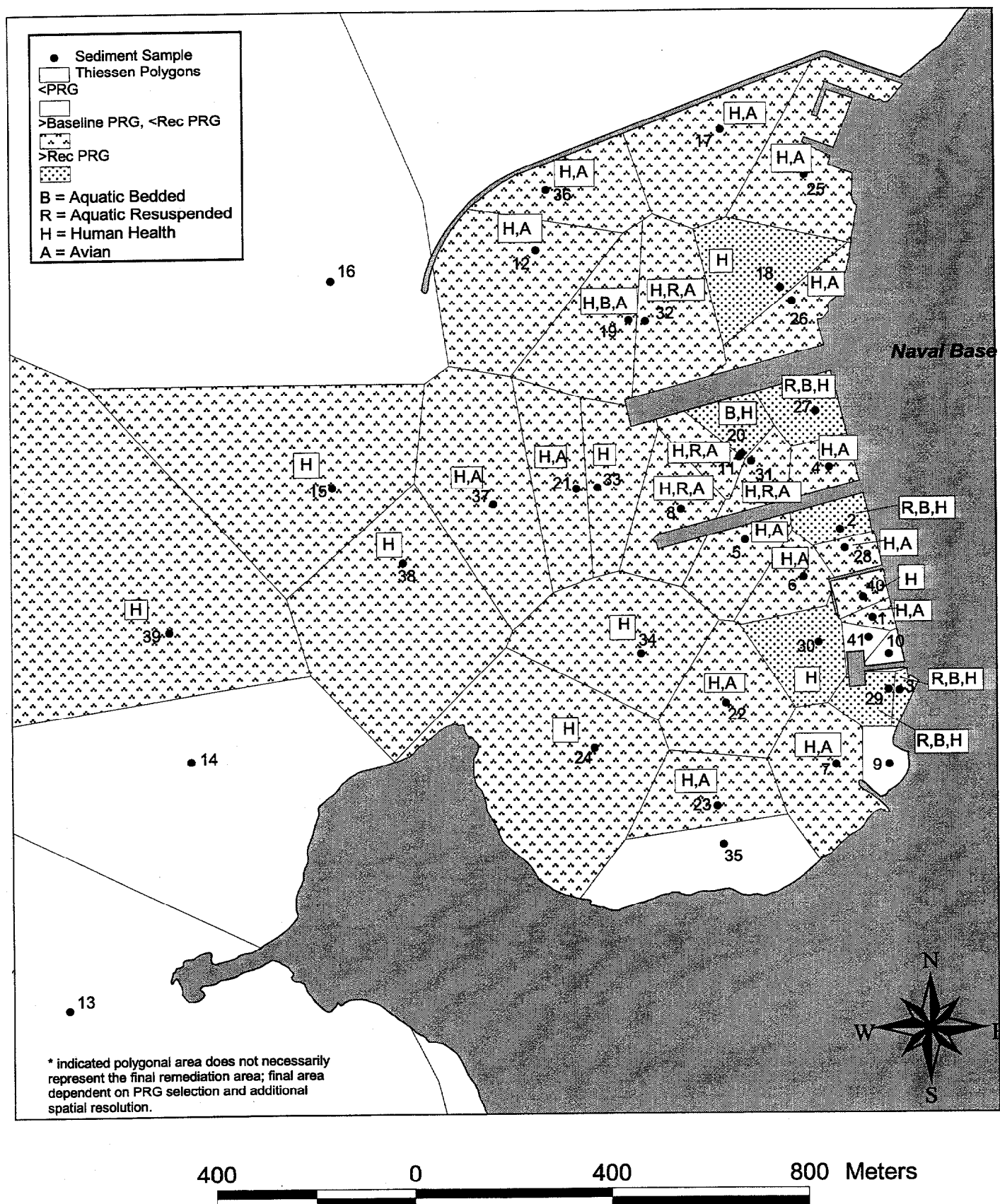
Table 1. Potential Remedial Action Objectives for the Derecktor Shipyard/ Coddington Cove study area.

Media/Receptor	Remedial Action Objectives (RAOs)
Aquatic Organisms	• Prevent exposure of aquatic organisms to bedded (in place) sediments with CoC concentrations exceeding the recommended PRGs. • Prevent exposure of aquatic organisms to sediments with CoC concentrations exceeding the recommended PRGs and that are present within areas where resuspension could occur.
Avian	• Prevent exposure of avian predators to shellfish that are impacted by sediments with CoC concentrations exceeding the selected PRGs and are within areas where shellfish predation could regularly occur.
Human Health	• Prevent human ingestion of shellfish that are impacted by sediments with CoC concentrations exceeding the selected PRGs, and are within areas where shellfishing could regularly occur.

Table 2. Chemical-specific ARARs for the Derecktor Shipyard/Coddington Cove study area.

MEDIA	REQUIREMENT	STATUS	SYNOPSIS	APPLICABILITY TO SITE CONDITIONS
Groundwater (Federal)	Federal Resource Conservation and Recovery Act (RCRA), Subpart F (40 CFR 264.94), Ground-Water Protection Standards and Alternate Concentration Levels.	To Be Considered	Allows for the development of ACL for facilities which treat, store, or dispose of hazardous wastes when the characteristics of the ground water (e.g. high salinity) limit the application of MCLs or health-based criteria. Exposure-based ACL may be developed which take into account potentially adverse effects on groundwater quality and hydraulically connected surface water quality.	Although currently undeveloped, ACL for groundwater may be relevant and appropriate to the development of site-specific PRGs.
	Federal Clean Water Act (CWA) (33 USC 1251-1376); Clean Water Act, Water Quality Criteria, Section 404 (40 CFR 230)	To Be Considered	Non-enforceable guidelines established for the protection of human health and/or aquatic organisms. These guidelines are used by states to set water quality standards for surface water.	AWQC, with modification, may be relevant and appropriate for the development of PRGs for groundwater which enters a surface water.
	Federal Safe Drinking Water Act	Relevant and Appropriate	Establishes drinking water MCLs and health-based criteria.	Appropriate for the development of PRGs for remedial actions involving the discharge of treated groundwater.
Surface Water (Federal)	Federal Clean Water Act (CWA) (33 USC 1251-1376); Clean Water Act, Water Quality Criteria, Section 404 (40 CFR 230)	Relevant and Appropriate or Applicable	Non-enforceable guidelines established for the protection of human health and/or aquatic organisms. These guidelines are used by states to set water quality standards for surface water.	AWQC are relevant and appropriate to the development of PRGs for surface water. AWQC will also be applicable to remedial alternatives which involve discharges to surface water.
Soil/Sediment (Federal)	Toxicity Characteristic (40 CFR 261-24)	To Be Determined	Establishes maximum concentrations of CoC for the TCLP test method described in 40 CFR 261, Appendix II.	Applicable where wastes produced during remedial action require handling as a hazardous waste based upon results of TCLP analysis.
	Land Disposal Restrictions (40 CFR 268)	To Be Determined	Establishes maximum concentrations of CoCs on the basis of which hazardous wastes area restricted from land disposal.	Applicable to remedial alternatives which specify the land disposal of hazardous wastes.
	Toxic Substances Control Act (TSCA) (40 CFR 761.125)	Relevant and Appropriate	Establishes PCB cleanup levels for soils and solid surfaces.	Applicable to spills of materials containing PCBs at concentrations of 50 mg/kg or greater that occurred after May 4 1987. Although landfill operations ceased in 1972, this regulation may still be relevant and appropriate for the development of the PRG.
	EPA Proposed Sediment Quality Criteria (Fed. Reg. Vol. 59, No. 11, 18 January 1994)	To Be Considered	Establishes proposed levels of five priority pollutants in fresh and saltwaters for the protection of benthic organisms.	To be considered for the development of PRGs.
	EPA Interim Sediment Criteria Values for Non-Polar Hydrophobic Organic Contaminants (EPA SCD#17 May 1988)	To Be Considered	Screening values for contaminants in sediments.	To be considered for the development of PRGs. EPA's proposed criteria are contained in the 1994 document (above).
	Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund Sites (OWSER 9355, 4-02)	To Be Considered	Sets as an interim soil cleanup level for lead at 500 to 1,000 mg/kg.	To be considered for the development of PRGs.
Groundwater (State)	Rules and Regulations for Groundwater Quality Criteria (CRIR No. 12-100-006)	To Be Considered	Establishes water classifications and water quality criteria. Also establishes acute and chronic water quality criteria for the protection of aquatic life.	Class GA WQS, with modification, may be relevant and appropriate to the development of PRGs for groundwater based upon the potential discharge following treatment to fishable surface water.
	Groundwater Protection Act of 1985 (RIGL 46 13.1)	Applicable	Establishes the policy for maintaining and restoring groundwater quality and presents groundwater classifications.	Applicable to Class GB groundwater within the state of Rhode Island.
Surface Water (State)	Rules and Regulations for Groundwater Quality Criteria (CRIR No. 12-100-006)	Relevant and Appropriate or Applicable	Establishes water classifications and water quality criteria. Also establishes acute and chronic water quality criteria for the protection of aquatic life.	WQS are relevant and appropriate to the development of PRGs for surface water. WQS will also be applicable for remedial alternatives which involve discharges to surface water.
	Water Quality Regulations for Water Pollution Control	Applicable	Establishes water quality criteria and water classifications.	Applicable to Class SA surface water for the development of PRGs.
Soils (State)	Rules and Regulations for Lead Poisoning Prevention	Applicable	RIDEM, in conjunction with RIDOH, established a permissible level of lead in soil at 500 mg/kg for surface soils and 1,000 mg/kg for subsurface soils. A "lead-free" level in soil was defined as 150 mg/kg.	Applicable to the development of soil PRGs.
	RI Hazardous Waste Management Act of 1987 (RIGL 23-19.1 et seq.)	Relevant and Appropriate or Applicable	Defines Type 6 - Extremely hazardous waste at including wastes which contain PCB at a concentration of 50 mg/kg or greater or showing 10 µg/100 cm^2 or greater as measured by a standard wipe test.	Relevant and appropriate for the development of soil PRGs. Applicable for remedial actions which involve handling hazardous wastes.
	Rules and Regulations for Solid Waste Management	Relevant and Appropriate or Applicable	Defines solid waste as including any soil, debris, or other material with a concentration of PCBs of 10 ppm or greater as measured by a standard wipe test.	Relevant and appropriate for the development of soil PRGs. Applicable for remedial action which involve handling solid wastes.

Table 3. Procedure for Preliminary Remediation Goals (PRGs) development for aquatic, avian predator and human health exposure pathways in the Derecktor Shipyard/Coddington Cove study area.

PROCEDURE	EXPOSURE PATHWAY			
	Aquatic Bedded	Aquatic Resuspended	Avian Predator	Human Health
1 - Identify primary CoC exposure pathways and benchmarks to be used to express risks.	Exposure pathway = porewater; Benchmark = Water Quality Screening Values (WQSV); PW-HQ = Porewater (PW) concentration/WQSV.	Exposure pathway = Elutriate water; Benchmark = Water Quality Screening Values (WQSV); Elu-HQ = Elutriate (Elu) concentration/WQSV.	Exposure pathway = Fish and shellfish consumption; Benchmark = Toxicity Reference Value (TRV); TRV-HQ = Tissue concentration of prey species/TRV.	Exposure pathway = Shellfish consumed by subsistence fishermen; Benchmark = minimum Reasonable Maximum Exposure (RME) value; RME-HQ = Shellfish tissue concentration/RME.
2 - Evaluate CoC bioavailability under site-specific conditions.	Estimate 95% Upper Confidence Limit (95% UCL) of PW-HQs associated with non-toxic samples; set NOEQ = 1 where 95% UCL<1.	Estimate 95% Upper Confidence Limit (95% UCL) of Elu-HQs associated with non-toxic samples; set NOEQ = 1 where 95% UCL<1.	TRV based on avian predator exposure model for species living in the New England region.	RME based on human health exposure model for recreational shellfishing characteristics in the New England region.
3 - Retain CoCs substantially contributing to risk at the site.	Retain CoCs for which the Maximum PW-HQ associated with toxic samples > NOEQ.	Retain CoCs for which the Maximum Elu-HQ associated with toxic samples > NOEQ.	Retain CoCs with TRV-HQ>1.	Retain carcinogenic CoCs with risk > 1×10^{-6}; Retain non-carcinogenic CoCs with HQ>1.
4 - Evaluate feasibility of pathway/CoC-specific PRG as a long-term remedial goal.	Compare Aquatic NOEC[1] and Reference Screening Value (RSV) for CoCs in porewater; select greater of two values as aquatic Threshold Effects Value (TEV).	Compare Aquatic NOEC[1] and Reference Screening Value (RSV) for CoCs in resuspended sediment; select greater of two values as aquatic Threshold Effects Value (TEV).	Compare Avian Predator TRV and Reference Screening Value (RSV) for CoCs in prey species tissues; select greater of two values as avian predator Threshold Effects Value (TEV).	Compare human health RME and Reference Screening Value (RSV) for CoCs in shellfish species tissues; select greater of two values as human health Threshold Effects Value (TEV).
5 - Rank pathway-specific TEV-HQs and select CoCs with maximum HQs by station and pathway as "limiting" CoCs.	Calculate Aquatic TEV-HQs as station-specific PW conc./TEV; identify maximum TEV-HQ by station; compile resulting list as "limiting" Aquatic CoCs for PRG development.	Calculate Aquatic TEV-HQs as station-specific Elu conc./TEV; identify maximum TEV-HQ by station; compile resulting list as "limiting" Aquatic CoCs for PRG development.	Calclate Avian Predator TEV-HQs as station-specific prey tissue conc./TEV; identify maximum TEV-HQ by station; compile resulting list as "limiting" Avian Predator CoCs for PRG development.	Calculate Human Health TEV-HQs as station-specific shellfish tissue conc./TEV; identify maximum TEV-HQ by station; compile resulting list as "limiting" Human Health CoCs for PRG development.
6 - Determine PRGs for "limiting" CoCs, I.e., convert TEV values in concentration-based units to be used during remediation.	For metal CoCs, use aquatic TEVs as PRGs (units = µg/L); derive organic PRGs (units = ng/g dry wt sediment) from TEV using EqP model.	For metal CoCs, use aquatic TEVs as PRGs (units = µg/L); derive organic PRGs (units = ng/g dry wt sediment) from TEV using EqP model.	Calculate PRGs (units = ng/g dry wt sediment) from avian TEVs using BAF (metals) and BSAF (organics) models.	Calculate PRGs (units = ng/g dry wt sediment) from human health TEVs using BAF (metals) and BSAF (organics) models.
7 - Evaluate practicality of pathway-specific PRGs for effective risk reduction.	Compare PRG exceedence to aquatic risk distribution.	Compare PRG exceedence to aquatic risk distribution.	Compare PRG exceedence to avian predator risk distribution.	Compare PRG exceedence to human health risk distribution.

1 - NOEC = NOEQ x WQSV.

Table 4. Water Quality Criteria for target analytes selected for aquatic PRG development and derived Water Quality Screening Values.

Chemical Class	Analyte[3,4]	EPA Water Quality Criteria[1]				NOAA	WQSV[1,2]	
		WQC-FA	WQC-FC	WQC-SA	WQC-SC	ER-L	Conc.	DQ
Metals	Arsenic	360	190	69.00	36.00	8.20	36.00	A
	Cadmium	3.90	1.10	43.00	9.30	1.20	9.30	A
	Chromium	1700	210	1100	50.00	81.00	50.00	A
	Copper	18.00	12.00	2.90	2.90	34.00	2.90	A
	Lead	83.00	3.20	220	8.50	46.70	8.50	A
	Mercury	2.40	0.01	2.10	0.03	0.15	0.03	A
	Nickel	1400	160	75.00	8.30	20.90	8.30	A
	Silver	0.92	0.12	7.20	0.92	1.00	0.92	A
	Zinc	120	110	95.00	86.00	150	86.00	A
	SEM:AVS						5.00	F
PAHs	1,6,7-Trimethylnaphthalene							NA
	1-Methylnaphthalene							NA
	1-Methylphenanthrene							NA
	2,6-Dimethylnaphthalene							NA
	2-Methylnaphthalene					70.00	0.88	E
	Acenaphthene	1700	520	970	710	16.00	710	A
	Acenaphthylene					44.00	0.46	E
	Anthracene					85.30	0.29	E
	Benzo(a)anthracene					261	0.07	E
	Benzo(a)pyrene					430	0.04	E
	Benzo(b)fluoranthene							NA
	Benzo(e)pyrene							NA
	Benzo(g,h,i)perylene							NA
	Benzo(k)fluoranthene							NA
	Biphenyl							NA
	Chrysene					384	0.10	E
	Dibenz(a,h)anthracene					63.40	1.68E-03	E
	Fluoranthene	3980		40.00	16.00	600	16.00	A
	Fluorene					19.00	0.14	E
	Indeno(1,2,3-cd)pyrene							NA
	Naphthalene	2300	620	2350		160	620	B
	Perylene							NA
	Phenanthrene	30.00	6.30	7.70	4.60	240	0.81	A
	Pyrene					665	0.63	E
	LMW PAHs					552	5.26	E
	HMW PAHs					1700	0.29	E
	Total PAHs					4022	5.09	NA
PCBs	Total PCBs	2.00	0.01	10.00	0.03	22.70	0.03	A
Pesticides	Aldrin	3.00		1.30			0.16	B
	Hexachlorobenzene	6.00	3.68				3.68	C
	Mirex		1.00E-03		1.00E-03		1.00E-03	A
	o,p'-DDE			0.13	1.00E-03	2.20	1.00E-03	B
	p,p'-DDE			0.13	1.00E-03	2.20	1.00E-03	B
TBT	Tributyltin							NA

DQ - Data Qualifier (see Figure 2.2-1).
WQC-FA = Water Quality Criteria = Freshwater Acute Value
WQC-FC = Water Quality Criteria = Freshwater Chronic Value
WQC-SA = Water Quality Criteria = Saltwater Acute Value
WQC-SC = Water Quality Criteria = Saltwater Chronic Value
WQSV = Water Quality Screening Value
WQSV CODES:
NA= Benchmark not available to derive Screening Value
A- WQC-SC VALUE
B- 8:1 ACUTE/CHRONIC RATIO APPLIED TO WQ-SA VALUE (Shepard, 1995); * = Acute value based on LOAEL
C- WQC-FC VALUE
D- 8:1 ACUTE/CHRONIC RATIO APPLIED TO WQ-FA VALUE (Shepard, 1995).
E- EqP PARTITIONING OF ER-L SEDIMENT BENCHMARK INTO POREWATER AT 1% TOC
1- Units: µg/L.
2- See text and Figure 2.2-1 for WQSV derivation process.
3- LMW PAH = ten 2-ring & 3-ring PAHs; HMW-PAH = eight 4-ring and 5-ring PAHs; Total PAH = sum of LMW and HMW PAHs (NOAA, 1991)
LMW PAH, HMW PAH Kow = median of analyte specific Kows
4 - Assumed to be the same as DDT.

Table 5A. Distribution of toxic and non-toxic aquatic Hazard Quotients and derivation of No Observable Effect Quotients for the aquatic receptors exposed to CoC via bedded and resuspended sediment aquatic exposure pathways for the Derecktor Shipyard/Coddington Cove study area.

BEDDED SEDIMENT		Bedded Sediment Exposure (Amphipod Survival)						
		Non-Toxic Samples			Toxic Samples			
Class	Analyte[2]	N	95% UCL PW-HQ[3]	AMP-NOEQ	N	Max. PW-HQ[3]	Max. PW-HQ > NOEQ?	AQ-BED NOEQ[4]
MET	Arsenic	0			0		NO	
MET	Cadmium	0			0		NO	
MET	Chromium	0			0		NO	
MET	Copper	0			0		NO	
MET	Lead	0			0		NO	
MET	Mercury	0			0		NO	
MET	Nickel	0			0		NO	
MET	Silver	0			0		NO	
MET	Zinc	0			0		NO	
MET	SEM:AVS	15.00	-0.67	5.00	2.00	-11.10	NO	
PAH	1,6,7-Trimethylnaphthalen	0			0		NO	
PAH	1-Methylnaphthalene	0			0		NO	
PAH	1-Methylphenanthrene	0			0		NO	
PAH	2,6-Dimethylnaphthalene	0			0		NO	
PAH	2-Methylnaphthalene	15.00	0.16	1.00	2.00	0.16	NO	
PAH	Acenaphthene	15.00	3.60E-04	1.00	2.00	1.27E-04	NO	
PAH	Acenaphthylene	15.00	0.84	1.00	2.00	0.87	NO	
PAH	Anthracene	15.00	1.38	1.38	2.00	1.21	NO	
PAH	Benzo(a)anthracene	15.00	0.73	1.00	2.00	0.83	NO	
PAH	Benzo(a)pyrene	15.00	0.45	1.00	2.00	0.58	NO	
PAH	Benzo(b)fluoranthene	0			0		NO	
PAH	Benzo(e)pyrene	0			0		NO	
PAH	Benzo(g,h,i)perylene	0			0		NO	
PAH	Benzo(k)fluoranthene	0			0		NO	
PAH	Biphenyl	0			0		NO	
PAH	Chrysene	15.00	0.59	1.00	2.00	0.64	NO	
PAH	Dibenz(a,h)anthracene	15.00	0.45	1.00	2.00	0.56	NO	
PAH	Fluoranthene	15.00	0.02	1.00	2.00	0.01	NO	
PAH	Fluorene	15.00	1.23	1.23	2.00	0.87	NO	
PAH	Indeno(1,2,3-cd)pyrene	0			0		NO	
PAH	Naphthalene	15.00	1.22E-03	1.00	2.00	9.01E-04	NO	
PAH	Perylene	0			0		NO	
PAH	Phenanthrene	15.00	0.67	1.00	2.00	0.38	NO	
PAH	Pyrene	15.00	0.64	1.00	2.00	0.79	NO	
PAH	LMW PAHs	15.00	3.38	3.38	2.00	2.58	NO	
PAH	HMW PAHs	15.00	2.87	2.87	2.00	3.41	YES	2.87
PAH	Total PAHs	15.00	6.22	6.22	2.00	5.99	NO	
PCB	Total PCBs	15.00	0.11	1.00	2.00	1.78	YES	1.00
PST	Aldrin	15.00	1.91E-05	1.00	2.00	6.72E-06	NO	
PST	Hexachlorobenzene	15.00	2.83E-06	1.00	2.00	1.46E-06	NO	
PST	Mirex	15.00	6.14E-03	1.00	2.00	0.01	NO	
PST	o,p'-DDE	15.00	0.02	1.00	2.00	0.40	NO	
PST	p,p'-DDE	15.00	0.02	1.00	2.00	0.04	NO	

PW-HQ=Porewater Hazard Quotient, ELU-HQ=Elutriate Hazard Quotient.

1 - NOEQ = No Observable Effect Quotient = greater of 95% Upper Confidence Limit (UCL) HQ or 1.

2 - SEM-AVS expressed as µmol/g dry wt. sediment (benchmark from USEPA, 1996).

3- Porewater Hazard Quotients: from Table A-3.2; segregated by amphipod survival results, see Tables A-3.3A (no toxicity) and A-3.3B (toxicity);

4 - If Max PW-HQ>NOEQ, AQ BED-NOEQ = NOEQ

Table 5B. Distribution of toxic and non-toxic aquatic Hazard Quotients and derivation of No Observable Effect Quotients for the aquatic receptors exposed to CoC via bedded and resuspended sediment aquatic exposure pathways for the Derecktor Shipyard/Coddington Cove study area.

RESUSPENDED SEDIMENT		Resuspended Sediment (Sea Urchin Fertilization)							Resuspended Sediment (Sea Urchin Development)							
		Non-Toxic Samples			Toxic Samples				Non-Toxic Samples			Toxic Samples				
		N	95% UCL	NOEQ[1]	N	Max.	Max. ELU-HQ	FERT[4A]	N	95% UCL	NOEQ[1]	N	Max.	Max. ELU-HQ	DEV[4B]	AQ ELU[5]
Class	Analyte[6]		ELU-HQ[3]			ELU-HQ[3]	> NOEQ?	NOEQ		ELU-HQ[3]			ELU-HQ[3]	> NOEQ?	NOEQ	NOEQ
MET	Arsenic	9.00	0.84	1.00	0		NO		2.00	1.12	1.12	7.00	2.11	YES	1.12	1.12
MET	Cadmium	9.00	0.01	1.00	0		NO		2.00	0.01	1.00	7.00	0.01	NO		
MET	Chromium	9.00	8.00E-03	1.00	0		NO		2.00	8.00E-03	1.00	7.00	8.00E-03	NO		
MET	Copper	9.00	0.58	1.00	0		NO		2.00	0.43	1.00	7.00	1.76	YES	1.00	1.00
MET	Lead	9.00	1.29	1.29	0		NO		2.00	1.06	1.06	7.00	1.87	YES	1.06	1.06
MET	Mercury	9.00	4.00	4.00	0		NO		2.00	4.00	4.00	7.00	4.00	NO		
MET	Nickel	9.00	0.48	1.00	0		NO		2.00	0.48	1.00	7.00	0.48	NO		
MET	Silver	9.00	0.27	1.00	0		NO		2.00	0.27	1.00	7.00	0.27	NO		
MET	Zinc	9.00	0.05	1.00	0		NO		2.00	0.05	1.00	7.00	0.05	NO		
MET	SEM:AVS	17.00	1.06	1.06	0		NO		6.00	1.70	1.70	8.00	1.51	NO		
PAH	1,6,7-Trimethylnaphthale	0			0		NO		0			0		NO		
PAH	1-Methylnaphthalene	0			0		NO		0			0		NO		
PAH	1-Methylphenanthrene	0			0		NO		0			0		NO		
PAH	2,6-Dimethylnaphthalene	0			0		NO		0			0		NO		
PAH	2-Methylnaphthalene	9.00	7.34E-03	1.00	0		NO		2.00	6.57E-03	1.00	7.00	0.01	NO		
PAH	Acenaphthene	11.00	6.53E-06	1.00	0		NO		3.00	3.45E-06	1.00	8.00	3.90E-05	NO		
PAH	Acenaphthylene	11.00	8.44E-03	1.00	0		NO		3.00	0.01	1.00	8.00	0.03	NO		
PAH	Anthracene	10.00	0.04	1.00	0		NO		2.00	0.05	1.00	8.00	0.16	NO		
PAH	Benzo(a)anthracene	10.00	0.23	1.00	0		NO		2.00	0.19	1.00	8.00	0.71	NO		
PAH	Benzo(a)pyrene	11.00	0.29	1.00	0		NO		3.00	0.28	1.00	8.00	0.97	NO		
PAH	Benzo(b)fluoranthene	0			0		NO		0			0		NO		
PAH	Benzo(e)pyrene	0			0		NO		0			0		NO		
PAH	Benzo(g,h,i)perylene	0			0		NO		0			0		NO		
PAH	Benzo(k)fluoranthene	0			0		NO		0			0		NO		
PAH	Biphenyl	0			0		NO		0			0		NO		
PAH	Chrysene	9.00	0.08	1.00	0		NO		2.00	0.06	1.00	7.00	0.33	NO		
PAH	Dibenz(a,h)anthracene	11.00	3.69	3.69	0		NO		3.00	6.84	6.84	8.00	6.84	NO		
PAH	Fluoranthene	11.00	1.87E-03	1.00	0		NO		3.00	1.19E-03	1.00	8.00	7.36E-03	NO		
PAH	Fluorene	11.00	0.04	1.00	0		NO		3.00	0.04	1.00	8.00	0.18	NO		
PAH	Indeno(1,2,3-cd)pyrene	0			0		NO		0			0		NO		
PAH	Naphthalene	9.00	1.57E-05	1.00	0		NO		2.00	1.55E-05	1.00	7.00	2.36E-05	NO		
PAH	Perylene	0			0		NO		0			0		NO		
PAH	Phenanthrene	11.00	0.01	1.00	0		NO		3.00	0.01	1.00	8.00	0.04	NO		
PAH	Pyrene	11.00	0.19	1.00	0		NO		3.00	0.44	1.00	8.00	0.49	NO		
PAH	LMW PAHs	11.00	0.09	1.00	0		NO		3.00	0.08	1.00	8.00	0.39	NO		
PAH	HMW PAHs	11.00	4.44	4.44	0		NO		3.00	7.32	7.32	8.00	8.37	YES	7.32	7.32
PAH	Total PAHs	11.00	4.54	4.54	0		NO		3.00	7.37	7.37	8.00	8.46	YES	7.37	7.37
PCB	Total PCBs	11.00	1.43	1.43	0		NO		3.00	2.31	2.31	8.00	2.59	YES	2.31	2.31
PST	Aldrin	11.00	9.05E-03	1.00	0		NO		3.00	9.82E-03	1.00	8.00	9.82E-03	NO		
PST	Hexachlorobenzene	11.00	6.58E-05	1.00	0		NO		3.00	2.45E-04	1.00	8.00	2.45E-04	NO		
PST	Mirex	11.00	0.32	1.00	0		NO		3.00	0.60	1.00	8.00	0.71	NO		
PST	o,p'-DDE	11.00	2.48	2.48	0		NO		3.00	2.80	2.80	8.00	3.52	YES	2.80	2.80
PST	p,p'-DDE	11.00	0.48	1.00	0		NO		3.00	0.59	1.00	8.00	0.71	NO		

PW-HQ=Porewater Hazard Quotient, ELU-HQ=Elutriate Hazard Quotient.

1 - NOEQ = No Observable Effect Quotient = greater of 95% Upper Confidence Limit (UCL) HQ or 1.

2 - SEM-AVS expressed relative to 5 µmol/g dry wt. sediment benchmark (from USEPA, 1996).

3- Elutriate Hazard Quotients: from Table A-4.2; segregated by sea urchin fertilization results, see Table A-4.3A (no toxicity) and Table A-4.3B (toxicity);

for sea urchin larval development (elutriates), see Tables A-4.4A (no toxicity) and A-4.4B (toxicity).

4A - If Max FERT ELU-HQ > NOEQ, FERT NOEQ = NOEQ.

4B - If Max DEV ELU-HQ > NOEQ, DEV NOEQ = NOEQ.

5 - Aquatic NOEQ = minimum of TEST-specific NOEQs.

6 - SEM concentration used; AVS assumed = 0 in resuspended sediment.

Table 6. Derivation of Aquatic Reference Screening Values based on concentrations for selected contaminants in porewater[1] and elutriates from Narragansett Bay reference locations.

POREWATERS

Class	Analyte[2,4]	Pathway	JCC-D1	JCC-D1-BOT	JCC-D1-MID	JCC-M1	JCC-S1	JPC-1	JPC-2	JSC-D1	JSC-DC1	JSC-V1	JSC-W1	PCC-D1	PCC-DC1[2]	PCC-V1	PCC-W1	n	t0.975	Mean	95% UCL	Aquatic RSV[3]
PAH	HMW PAHs	PW	0.07	8.63E-03		0.03	0.07	0.10		2.70E-03	2.44E-03	0.04	0.54	1.62E-03	2.14E-03	0.01	1.08	13.00	2.13	0.15	0.19	0.34
PCB	Total PCBs	PW		1.59E-04	2.92E-04	1.44E-04	2.07E-04	2.67E-04		3.58E-05	6.71E-05	1.06E-04		1.12E-04	7.54E-05	7.62E-05		11.00	2.13	1.40E-04	5.39E-05	1.94E-04
MET	Arsenic	ELU						18.30										1.00	2.13	18.30		
MET	Copper	ELU						1.25										1.00	2.13	1.25		
MET	Lead	ELU						13.20										1.00	2.13	13.20		
PAH	HMW PAHs	ELU						209										1.00	2.13	209		
PAH	Total PAHs	ELU						237										1.00	2.13	237		
PCB	Total PCBs	ELU						48.37										1.00	2.13	48.37		
PST	o,p'-DDE	ELU						3.59										1.00	2.13	3.59		
TOC	% TOC	ELU	1.79	1.47	3.73	4.01	6.09	3.79	3.84	3.57	1.66	3.18	0.61	3.55	2.55	1.48	0.81	15.00	2.13	2.81		

Missing PW values indicate outliers removed from the RSV calculation. Outliers are defined as values greater than the mean + 2 standard deviations of the mean for all data.

Only one sample was available for ELU data; hence no outlier analysis was performed.

1-Porewater concentration (µg/L) = sediment concentration/(foc X Koc). See Table A-1 for Koc values.

foc = %TOC/100.

Data Sources: SAIC, 1996 (JSC/PCC - Allen Harbor ERA reference locations), Appendix A-1-1 (sediment concentrations) and A-1-3 (porewater concentrations);

SAIC and URI, 1997a (JCC - McAllister Point ERA reference location), Appendix A-1-1-1 (sediment organic chemistry), A-1-2-1 (sediment metals chemistry), and A-1-2-3 (porewater metals chemistry);

SAIC and URI, 1997b (JPC/CHC - Derecktor Shipyard ERA reference locations), Appendix A-1-1 (sediment chemistry) and A-1-2 (elutriate chemistry).

2 - List includes analytes for which NOEQs were developed; see Table 5A (PW) and Table 5B (ELU).

3 - Aquatic Reference Screening Value (RSV) calculated as 95% Upper Confidence Limit based on sample size as follows:

Mean + ($t_{0.975}$(df)*(STDEV/(SQRT(n)))); where STDEV=standard deviation; n=sample size;

$t_{0.975}$(df) = sample size-dependent percentage points of the t distribution, (Ott, 1993).

4 - Koc for Aroclor 1254 assumed for Total PCBs (see Table A-1).

Table 7. Derivation of Threshold Effects Values (TEVs) for bedded (PW) and resuspended (ELU) aquatic exposure pathways in the Derecktor Shipyard/Coddington Cove study area.

Class	Analyte[1]	Exposure Pathway[1]	Aquatic NOEQ[2]	NOEC[3,5] (µg/L)	Aquatic RSV[4] (µg/L)	Aquatic TEV[5] (µg/L)	L-CoC?[6]
PAH	HMW PAHs	PW	2.87	0.82	0.34	0.82	yes
PCB	Total PCBs	PW	1.00	0.03	1.94E-04	0.03	yes
MET	Arsenic	ELU	1.12	40.40	18.30	40.40	yes
MET	Copper	ELU	1.00	2.90	1.25	2.90	yes
MET	Lead	ELU	1.06	9.00	13.20	13.20	yes
PAH	HMW PAHs	ELU	7.32	2.09	0.21	2.09	no
PAH	Total PAHs	ELU	7.37	37.51	0.24	37.51	no
PCB	Total PCBs	ELU	2.31	0.07	0.05	0.07	yes
PST	o,p'-DDE	ELU	2.80	2.80E-03	3.59E-03	3.59E-03	yes

PW=Porewater, ELU=Elutriate.

NOEQ=No Observable Effect Quotient; WQSV=Water Quality Screening Value; NOEC=No Observable Effect Concentration; RSV=Reference Screening Value; TEV=Toxicity Effect Value.

1 - List includes analytes for which Aquatic NOEQs were developed; see Table 5.

2 - Aquatic NOEQ = minimum of exposure pathway-specific NOEQs; see Table 5.

3 - NOEC = Aquatic NOEQ x WQSV (Table 4).

4 - RSV = reference data compiled by SAIC (Table 6).

5 - Aquatic TEV is the greater of the NOEC and RSV.

6- L-CoC = Limiting CoC; see Table A-5 for L-CoC derivation.

Table 8. Avian Predator Reference Screening Values for selected CoCs in tissues of prey from Narragansett Bay reference locations.

Class	Analyte[1]	C1-1/2/3-HC	C1-4-HC	CHC-1-CN	CHC-1-IBM	CHC-1-LOB	JCC-D1-LOB-HPP	JCC-D1-LOB-MUS	JCC-M1-HC	JCC-S1-HC	JPC-1-IBM	JPC-1-LOB	JPC-1-MF	JSCD1HCND	JSCW1MFMIX	PCCD1HCND	PCCW1HCND	PCCW1MFCOM	PCCW1MFMIX	PCCW1MFSTP	Mean	Avian Predator RSV[2]
Metals	Arsenic	11.30	19.30	3.48	4.68	21.68	19.77	19.82			6.77	19.43	5.92	5.91	2.88	10.44	17.66	1.25	6.83		11.07	14.96
	Cadmium	0.58	0.65	0.94	0.58	0.23	8.27	1.50E-03			0.59	0.18	1.18	0.20	0.11	0.30	0.37	0.19	0.10		0.41	0.60
	Chromium	7.57	8.73	1.22	1.84	1.43	0.11	0.11			2.44	1.68	1.08	2.65	0.69	2.82	4.06	1.36	1.76		2.05	3.08
	Copper	10.60	8.50	18.39	11.93	102	10.77	45.71			8.62	143	22.74	5.33	1.94	33.84	3.75	2.69	3.67		10.98	16.54
	Lead	0.85	0.99	0.84	0.78	0.18	0.09	0.14			3.28	0.39	0.43	0.79	0.14	0.91	0.59	0.70	0.26		0.54	0.72
	Mercury	0.08	0.13	0.17	0.18	0.23	0.11	0.56			0.17	0.30	0.11	0.01	0.07	0.10	0.01	0.10	0.01		0.12	0.16
	Silver		0.93	1.58	1.50E-04	3.84	1.25	0.84			1.50E-04	2.19	1.50E-04	1.79	0.81	4.15	1.69	0.69	0.92		0.98	1.41
	Zinc	112	97.50	21.97	91.68	119	65.15	102			92.83	106	34.06	74.10	167	89.64	86.11	160	186		100	124
PCBs	Total PCBs	53.54		1010	389	461	4210	106	91.43	37.73	565	397	1900	50.96	616	120	68.11			1191	470	766

Missing values indicate outliers removed from the RSV calculation. Outliers are defined as values greater than the mean + 2 standard deviations of the mean for all data.

Metals units=μg/g dry tissue wt.; organics units=ng/g dry tissue wt.

CN=cunner, HC=hard clams, IBM=indigenous blue mussels, LOB=lobster, LOB-HPP= lobster hepatopancreas, LOB-MUS=lobster muscle,

MF=marine fish, ND=non-depurated, DEP=depurated.

Data Sources: SAIC, 1996 (JSC/PCC - Allen Harbor ERA reference locations), Appendix A-1-2 (tissue concentrations);

SAIC and URI, 1997a (JCC - McAllister Point ERA reference location), Appendix A-1-1-2 (tissue organic chemistry) and A-1-2-2 (tissue metals chemistry),

SAIC and URI, 1997b (JPC/CHC - Derecktor Shipyard ERA reference locations), Appendix A-1-3 (tissue chemistry);

TRC, 1994 (C1 - NETC reference location).

1 - Analytes for which maximum TRV-HQs<1 were excluded from PRG development; see ERA Appendix A-2-4 (SAIC and URI 1997).

2 - Avian Predator Reference Screening Value (RSV) calculated as 95% Upper Confidence Limit based on sample size as follows:

Mean + $(t_{0.975}(df)*(STDEV/(SQRT(n)))$; where STDEV=standard deviation; n=sample size;

$t_{0.975}(df)$ = sample size-dependent percentage points of the t distribution (Ott, 1993).

Table 9. Derivation of Threshold Effects Values for the avian predator exposure pathway in the Derecktor Shipyard/Coddington Cove study area.

Class	Analyte[1]	Maximum TRV-HQ[2]	Avian Predator TRV[3] (mg/kg dry tiss. wt.)	Avian Predator RSV[4] (mg/kg dry tiss. wt.)	Avian Predator TEV[5] (mg/kg dry tiss. wt.)	L-CoC?[6]
Metals	Arsenic	3.50	8.18	14.96	14.96	no
	Cadmium	1.02	1.83	0.60	1.83	no
	Chromium	1.84	1.72	3.08	3.08	no
	Copper	3.24	60.71	16.54	60.71	yes
	Lead	1.87	3.11	0.72	3.11	yes
	Mercury	1.19	0.38	0.16	0.38	no
	Silver	6.16	1.11	1.41	1.41	yes
	Zinc	5.96	28.77	124	124	yes
PCBs	Total PCBs	13.50	0.29	0.77	0.77	yes

TRV=Toxicity Reference Value.

1 - Analytes identified in Table 8.

2 - Maximum TRV-HQ=maximum Hazard Quotient observed for any prey-receptor combination in the Derecktor Shipyard/Coddington Cove study area; see Appendix A-2-4 in Final Derecktor Shipyard Marine ERA (SAIC and URI, 1997b).

3 - TRV = minimum of receptor-specific TRV; see Table 6.3-2 in Final Derecktor Shipyard Marine ERA (SAIC and URI, 1997b).

4 - Avian Predator Reference Screening Value (RSV) ; see Table 8.

5 - Avian Threshold Effects Value (TEV); selected as greater of TRV and RSV.

6- L-CoC = Limiting CoC; see Table A-6 for L-CoC derivation.

Table 10. Summary of exposure parameter values used in estimating CoC exposures via shellfish consumption by subsistence fishermen in the Derecktor Shipyard/Coddington Cove study area.

Parameter	RME Value	Rationale	Reference
Global variables			
Body Weight (kg) - Shellfishing	70.00	Average of adults between 18-65 years of age.	USEPA 1994
Exposure Duration (yr) - Shellfishing and Residential (yr)	30.00	Median and upper-bound time at one residence, adults.	USEPA 1994
Averaging Time (days) - Cancer risks	25550	Based on 70 year life expectancy.	USEPA 1989b
- Noncancer risks Shellfishing and Residential	10950	Based on exposure duration.	USEPA 1989b
Relative Absorption Factors - Ingestion of shellfish			USEPA 1989b
VOCs	1.00		
PAHs	1.00		
PCBs	0.30		
Pesticides	0.30	Pesticides in this study are considered high sorption (logKow=5.89-6.89).	
Inorganics	1.00		
Lead	0.30		
Consumption of Locally-Caught Shellfish Scenario			
Exposure Frequency (day/yr)	350	Assumes two weeks vacation.	USEPA 1994
Ingestion Rate (g/day)	15.60	Based on 150 g shellfish per serving and 36.5 servings of shellfish per year.	USEPA 1994; Rupp *et al*. (1980)
Fraction of Ingested Shellfish Caught Locally	1.00	Conservative assumption in absence of site-specific data.	BPJ

NOTES:

RME: Reasonable Maximum Exposure.

BPJ: Best professional judgment.

Table 11. Toxicity values for Chemicals of Concern in shellfish tissue for the Derecktor Shipyard/Coddington Cove study area.

Class	Analyte	Cancer Slope Factor (SF)[1] (mg CoC/kg body wt-day^{-1})	Non-cancer Chronic Reference Dose (RfD)[1,3] (mg CoC/kg body wt-day^{-1})
		Ingestion	Ingestion
MET	Arsenic	1.50	3.00E-04
PAH	Benzo(a)anthracene	0.73	
PAH	Benzo(a)pyrene	7.30	
PAH	Dibenz(a,h)anthracene	7.30	
PAH	Indeno(1,2,3-cd)pyrene	0.73	
PCB	Total PCBs	2.00	

Cancer Slope Factors for all carcinogenic PAHs were set equal to the most toxic PAH, Benzo(a)pyrene.

1 - Original source for SF and RfD values from IRIS database (USEPA, 1997).

2 - Value adjusted in comparison to SF for benzo(a)pyrene; as per USEPA (1993) *Provisional Guidance For Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons.*

3 - Missing values indicates this CoC is not a non-carcinogenic CoC.

Table 12. Summary of risk-based concentration thresholds for CoCs in shellfish tissue for the Derecktor Shipyard/Coddington Cove study area.

		Risk-based Concentration (mg CoC/kg wet tissue wt.)[1]			Human Health Risk-
Class	Analyte	1×10^{-6} Cancer Risk[2]	1×10^{-4} Cancer Risk[2]	HQ = 1 Non-cancer Risk[3,4]	Based Value (RBV)[5]
MET	Arsenic	7.28E-03	0.73	1.40	0.05
PAH	Benzo(a)anthracene	0.01	1.50		0.11
PAH	Benzo(a)pyrene	1.50E-03	0.15		0.01
PAH	Dibenz(a,h)anthracene	1.50E-03	0.15		0.01
PAH	Indeno(1,2,3-cd)pyrene	0.01	1.50		0.11
PCB	Total PCBs	0.18	18.20		1.30

1 - Assumes Reasonable Maximum Exposure scenario.

 Benchmarks calculated for CoCs with > 1×10-6 cancer risk or HQ>1.0 non-cancer risk for HH ERA under RME exposure scenario.

2 - Derived using Equation 2 in Section 2.4.3 of text.

3 - Derived using Equation 1 in Section 2.4.3 of text.

4 - Missing values indicates this CoC is not a non-carcinogenic CoC in shellfish tissue under RME conditions based on baseline human health risk assessment results.

5 - Human Health Risk-based Value (RBV); minimum of risk-based RME values for carcinogenic and non-carcinogenic CoCs.

 Units: mg CoC/kg dry wt. tissue. Value converted to dry weight units dry wt=wet wt/% solids content (Table A-2.3).

Table 13. Derivation of Human Health Reference Screening Values based on concentrations of selected contaminants in tissues of shellfish harvested from lower Narragansett Bay for consumption by subsistence fishermen.

Class	Analyte[1]	C1-1/2/3	C1-4	CHC-1-IBM	CHC-1-LOB	JCC-D1-LOB-HPP	JCC-D1-LOB-MUS	JCC-M1-HC	JCC-S1-HC	JPC-1-IBM	JPC-1-LOB	JPC-1-MM	JPC-1-PM	JSCD1HCND	PCCD1HCND	PCCW1HCND	Mean	Human Health RSV[2]
MET	Arsenic	11.30	19.30	4.68	21.68	19.77	19.82			6.77	19.43	7.73	11.04	5.91	10.44	17.66	13.50	17.27
PAH	Benzo(a)anthracene	3.57	3.18	47.31	3.36	120	0.90	3.36	0.75	15.80	3.36	10.53	26.48	1.83	1.91	1.13	8.82	16.46
PAH	Benzo(a)pyrene	1.60	2.62	31.00	3.62	51.92	4.90	4.00	1.23	7.81	3.62	4.20	8.00	1.33	1.54	1.26	5.48	9.91
PAH	Dibenz(a,h)anthracene	0.79	1.12	0.49	0.49	0.49	0.49	0.49	0.18	0.49	0.49	0.49	0.49	1.30	1.05	1.40	0.68	0.88
PAH	Indeno(1,2,3-cd)pyrene	4.07	4.96	15.51	1.54	41.42	0.10	2.00	1.65	1.54	1.54	1.54	1.54	0.53	2.10	0.99	2.83	5.06
PCB	Total PCBs	53.54		389	461	4210	106	91.43	37.73	565	397	204	267	50.96	120	68.11	216	325

Units: metals units=μg/g dry tissue weight; organics=ng/g dry tissue weight.

HC=hard clams, PM=*Pitar morrhuana*, MM=*Mercenaria mercenaria*, ND=non-depurated, LOB=lobster, MUS=lobster muscle, HPP=lobster hepatopancreas, IBM=indigenous blue mussel.

Data Sources: JSC/PCC = Allen Harbor ERA reference locations (SAIC, 1996, Appendix Tables A-1-2 (tissue data));

JCC = McAllister Point ERA reference location (SAIC and URI, 1997a, Appendix A-1-1-2 (tissue organic data) and A-1-2-2 (tissue metals data));

JPC/CHC = Derecktor Shipyard ERA reference locations (SAIC and URI, 1997b, Appendix Tables A-1-3 (tissue data)).

TRC, 1994 (C1 - NETC reference location).

1 - List includes CoCs for which RBVs were developed; see Table 12.

2 - Human Health Reference Screening Value (RSV) calculated as 95% Upper Confidence Limit based on sample size as follows:

Mean + ($t_{0.975}(df)$*(STDEV/(SQRT(n))); where STDEV=standard deviation; n =sample size;

$t_{0.975}(df)$ = sample size-dependent percentage points of the t distribution (Ott, 1993).

Table 14. Derivation of Threshold Effects Values for the human health exposure pathway in the Derecktor Shipyard/Coddington Cove study area.

Class	Analyte	Human Health RBV[1] (mg/kg dry tiss. wt)	Human Health RSV[2] (mg/kg dry tiss. wt)	Human Health TEV[3] (mg/kg dry tiss. wt)	L-CoC?[4]
Metals	Arsenic	0.05	17.27	17.27	yes
	Benzo(a)anthracene	0.11	0.02	0.11	no
	Benzo(a)pyrene	0.01	9.91E-03	0.01	yes
	Dibenz(a,h)anthracene	0.01	8.83E-04	0.01	no
	Indeno(1,2,3-cd)pyrene	0.11	5.06E-03	0.11	no
PCBs	Total PCBs	1.30	0.33	1.30	no

1 - Human Health Risk-based Value (RBV); see Table 12.
2 - Human Health Reference Screening Value (RSV), see Table 13.
3 - Human Health Threshold Effects Values (TEV) = greater of RBV and RSV.
4 - L-CoC = Limiting CoC; see Table A-7 for L-CoC derivation.

Table 15. Summary of maximum TEV-HQs and identification of Limiting CoCs by sampling location for aquatic, avian predator and human health exposure pathways for the Derecktor Shipyard/Coddington Cove study area.

Exposure Pathway	Parameter	DSY-24	DSY-25	DSY-26	DSY-27	DSY-28	DSY-29	DSY-30	DSY-31	DSY-32	DSY-33	DSY-34	DSY-35	DSY-36	DSY-37	DSY-38	DSY-39	DSY-40	DSY-41
Aquatic (A)	TEV-HQ [1,2]		0.89	1.42	1.78		2.34	1.15										1.74	
Bedded	L-CoC		HMW PAHs	HMW PAHs	Total PCBs		HMW PAHs	HMW PAHs										HMW PAHs	
Aquatic (A)	TEV-HQ [1,2]		1.12		1.00		0.83		1.76	0.71	1.20			1.00	0.98	1.01	1.88	0.74	
Resuspended	L-CoC		Total PCBs		Total PCBs		o,p'-DDE		Copper	Lead	Lead			Arsenic	Lead	Arsenic	Arsenic	Arsenic	
Avian Predator (P)	TEV-HQ [1,3]	1.87	3.89	2.87	4.89	5.05	4.16		1.33		2.44		4.65	4.08		4.34	3.24	1.19	
	L-CoC	Lead	Silver	Total PCBs	Silver	Total PCBs	Silver		Zinc		Silver		Silver	Total PCBs		Silver	Copper	Total PCBs	
Human Health (HH)	TEV-HQ [1,4]		10.72	51.30	6.84	3.17	1.65		4.21	3.99	2.08	2.10	1.51	3.02	2.17	1.93	1.08		1.62
	L-CoC		Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Arsenic		Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Arsenic		Benzo(a) pyrene
Combined	TEV-HQ [1,5]	1.87	10.72	51.30	6.84	5.05	4.16	1.15	4.21	3.99	2.44	2.10	4.65	4.08	2.17	4.34	3.24	1.74	1.62
Exposure	L-CoC	Lead	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Total PCBs	Silver	HMW PAHs	Benzo(a) pyrene	Benzo(a) pyrene	Silver	Benzo(a) pyrene	Silver	Total PCBs	Benzo(a) pyrene	Silver	Copper	HMW PAHs	Benzo(a) pyrene
Pathway	Pathway [6]	P	HH	HH	HH	P	P	A	HH	HH	P	HH	P	P	HH	P	P	A	HH

TEV-HQ=Threshold Effects Value Hazard Quotient. L-CoC=Limiting Chemical of Concern. See text, Section 1.0. TEV-HQs<1 not reported.
1 - TEV-HQ = media-specifc concentration/analyte-pathway-specific TEV value.
2 - Values presented are maximum of Aquatic TEV-HQs by station. Complete TEV-HQ values presented in Tables A-5.
3 - Values presented are maximum of Avian Predator TEV-HQs by station. Complete TEV-HQ values presented in Table A-6.
4 - Values presented are maximum of Human Health TEV-HQs by station. Complete TEV-HQ values presented in Table A-7.
5 - Values presented are maximum of individual exposure pathway TEV-HQs by station.
6 - Limiting Exposure Pathway; A = Aquatic, P = Avian Predator, HH = Human Health.

Table 16. Summary of Preliminary Remediation Goals (PRGs) for aquatic, avian predator, human health, and combined exposure pathways for the Derecktor Shipyard/Coddington Cove study area.

| | | Preliminary Remediation Goal[1] | | | | | | | | | |
| | | Aquatic-Bedded[3A] | | Aquatic-Resuspended[3B] | | Avian Predator[4] | | Human Health[5] | | Combined Pathway | |
Class	Analyte[2]	HQ=1	RPRG	HQ=1	RPRG	HQ=1	RPRG	HQ=1	RPRG	HQ=1	RPRG
MET	Arsenic			24.63	NR	17.09	NR	19.74	NR	17.09	NR
MET	Copper			73.74	NR	184	NR			73.74	NR
MET	Lead			83.94	168	622000	NR			83.94	168
MET	Silver					2342	NR			2342	NR
MET	Zinc					118	NR			118	NR
PAH	Benzo(a)pyrene							53.92	539	53.92	539
PAH	HMW PAHs	6951	13903							6951	13903
PCB	Total PCBs	1638	1638	530	1060	92.82	NR			92.82	1060
PST	o,p'-DDE			9.06	NR					9.06	NR

RPRG - Recommended Preliminary Remediation Goal
NR - Not Recommended
1 - Pathway-specific PRGs expressed in concentration units for use during remediation.
PAHs, PCBs, pesticides: units = ng/g dry weight sediment
metals: units = µg/g dry weight sediment

2 - List includes only limiting CoCs, i.e., CoCs with maximum TEV-HQs by station and pathway (Table 15).

3A - Aquatic Bedded PRG at HQ=1 calculated as the mean (TEV*[Sed])/[PW];
REC = 2 x PRG at HQ = 1; adjusted to reduce risk to CoC exposure in bedded sediment of high risk areas. See text in Section 3.3.

3B - Aquatic Resuspended sediment PRG at HQ=1 calculated as the mean (TEV*[Sed])/[Elutriate]).
REC = 2 x PRG at HQ = 1; adjusted to reduce risk to CoC exposure during sediment resuspension in high risk areas. See text in Section 3.3.

4 - Avian predator PRG (at HQ=1) for organics calculated as [%TOC$_{avg}$ x ((Avian TEV*1000)/%lipid$_{avg}$))/BSAF];
For Metals, PRG conc. = [Avian TEV/BAF].
REC = NR; due to low risk and lack of probable exposure. See text Section 3.3.

5 - For PCBs, PRG (ng/g dry wt. sediment) = [%TOC$_{avg}$ x ((Human Health TEV)*(1000/%lipid$_{avg}$))/BSAF];
For metals, PRG (µg/g dry wt. sediment) = ((Human Health TEV)/BAF).
REC=10x PRG at HQ=1; adjusted for site usage ratio to address risk above HQ=10/1x10^{-5}. See text Section 3.3.

Data Sources:
- see Table 7 for Aquatic TEV concentrations (µg/L);
- see Table 9 for Avian Predator TEV concentrations (mg/kg dry weight);
- see Table 14 for Human Health TEV concentrations (mg/kg wet tissue weight);
- see Table 15 for maximum of pathway-specific TEV-HQ values;
- see Table A8 for calculation of mean aquatic bedded and resuspended pathway PRGs from station-specific PRGs;
- site average %lipid = 4.59, see Table A-2.3 for derivation;
- site average %TOC = 2.78, see Table A-2.1A for derivation;
- site average BAF for arsenic = 0.875; see Derecktor Shipyard ERA Figure 6.3-3;
- site average BAF for copper = 0.33; see Derecktor Shipyard ERA Figure 6.3-3;
- site average BAF for lead = 5.0E-6; see Derecktor Shipyard ERA Figure 6.3-3;
- site average BAF for silver = 0.0006; see Derecktor Shipyard ERA Figure 6.3-3;
- site average BAF for zinc = 1.05; see Derecktor Shipyard ERA Figure 6.3-3;
- site average BSAF for pesticides = 3.85; see Derecktor Shipyard ERA Figure 6.3-2;
- site average BSAF for PCBs = 5.00; see Derecktor Shipyard ERA Figure 6.3-2;
- site average BSAF for PAHs = 0.12; see Derecktor Shipyard ERA Figure 6.3-2.

Table A-1. Summary of Kow and Koc values used in calculations of organic contaminant concentrations in porewaters by equilibrium partitioning.

Class	Analyte	CAS No.	Full Analyte Name	$Log_{10}K_{OW}$	Source[1]	$Log_{10}K_{OC}$[2]	K_{OC}
MET	As		Arsenic	NA			
	Cd		Cadmium	NA			
	Cr		Chromium	NA			
	Cu		Copper	NA			
	Pb		Lead	NA			
	Hg		Mercury	NA			
	Ni		Nickel	NA			
	Ag		Silver	NA			
	Zn		Zinc	NA			
	SEM:AVS		SEM-AVS	NA			
PAH	T167NAP	2245387	1,6,7-Trimethylnaphthalene	4.61	b	4.53	34034
	M1NAPH	90120	1-Methylnaphthalene	3.97	b	3.90	7994
	M1PHEN	832699	1-Methylphenanthrene	5.08	b	4.99	98610
	D26NAPH	581420	2,6-Dimethylnaphthalene	4.61	b	4.53	34034
	M2NAPH	91576	2-Methylnaphthalene	3.97	b	3.90	7994
	ACENAPH	83329	Acenaphthene	3.92	a	3.85	7139
	ACENAPL	208968	Acenaphthylene	4.05	b	3.98	9581
	ANTHRAC	120127	Anthracene	4.55	a	4.47	29712
	BENAAN	56553	Benzo(a)anthracene	5.70	a	5.60	401218
	BENAPYR	50328	Benzo(a)pyrene	6.11	a	6.01	1014869
	BENBFLU	205992	Benzo(b)fluoranthene	6.20	a	6.09	1244171
	BENEPYR	192972	Benzo(e)pyrene	6.11	b	6.01	1014869
	BGHIPER	191242	Benzo(g,h,i)perylene	6.70	a	6.59	3858158
	BENKFLU	207089	Benzo(k)fluoranthene	6.20	a	6.09	1244171
	BIPHEN	92524	Biphenyl	3.96	a	3.89	7816
	CHRYSEN	218019	Chrysene	5.70	a	5.60	401218
	DBAHANT	53703	Dibenz(a,h)anthracene	6.69	a	6.58	3771812
	FLUORAN	206440	Fluoranthene	5.12	a	5.03	107954
	FLUOREN	86737	Fluorene	4.21	a	4.14	13763
	I123CDP	193395	Indeno(1,2,3-cd)pyrene	6.65	a	6.54	3445323
	NAPH	91203	Naphthalene	3.36	a	3.30	2010
	PERYL	198550	Perylene	6.05	b	5.95	885992
	PHENAN	85018	Phenanthrene	4.55	a	4.47	29712
	PYRENE	129000	Pyrene	5.11	a	5.02	105538
	LMWPAH	NA	Low Molecular Weight PAH	4.09	c	4.02	10489
	HMWPAH	NA	High Molecular Weight PAH	5.88	c	5.78	596218
	TOTPAH	NA	Total PAHs[3]	4.98	c	4.90	79082
PCB	PCB101	37680732	101 (2 2'3 5 5')	6.38	b	6.27	1869907
	PCB105	32598144	105 (2 3 3'4 4')	6.65	b	6.54	3445323
	PCB118	31508006	118 (2 3'4 4'5)	6.74	b	6.63	4223767
	PCB128	39380073	128 (2 2'3 3'4 4')	6.74	b	6.63	4223767
	PCB138	35065282	138 (2 2'3 4 4'5)	6.83	b	6.71	5178095
	PCB153	35065271	153 (2 2'4 4'5 5')	6.92	b	6.80	6348045
	PCB170	35065306	170 (2 2'3 3'4 4'5)	7.27	b	7.15	14018127
	PCB18	37680652	18 (2 2'5)	5.24	b	5.15	141645
	PCB180	35065293	180 (2 2'3 4 4'5 5')	7.36	b	7.24	17185414
	PCB187	52663680	187 (2 2'3 4'5 5'6)	7.17	b	7.05	11178667
	PCB195	52663782	195 (2 2'3 3'4 4'5 6)	7.56	b	7.43	27024645
	PCB206	40186729	206 (2 2'3 3'4 4'5 5'6)	8.09	b	7.95	89691234
	PCB209	2051243	209 (2 2'3 3'4 4'5 5'6 6')	8.18	b	8.04	109956270
	PCB28	7012375	28 (2 4 4')	5.67	b	5.57	374878
	PCB44	41464395	44 (2 2'3 5')	5.75	b	5.65	449293
	PCB52	35693993	52 (2 2'5 5)	5.84	b	5.74	550606
	PCB66	32598100	66 (2 3'4 4')	6.20	b	6.09	1244171
	PCB8	34883437	8 (2 4)	5.07	b	4.98	96403
	TOTPCB	NA	Total PCBs[4]	6.54	b	6.43	2685963
PST	ALDRIN	309002	Aldrin	6.50	a	6.39	2453466
	HCB	118741	Hexachlorobenzene	5.89	a	5.79	616808
	MIREX	2385855	Mirex	6.89	a	6.77	5931301
	DDE_OP	3424826	o,p'-DDE	6.76	a	6.65	4419366
	DDE_PP	72559	p,p'-DDE	6.76	a	6.65	4419366

1 - Literature source of $Log_{10}K_{OW}$ values:

a - Karickhoff and Long, 1995.

b - Karickhoff et al., 1989.

c - Calculated value

2 - $log_{10}K_{OC} = 0.00028 + 0.983 * log_{10}K_{OW}$; Karickhoff et al., 1989.

3 - LMW PAH = ten 2-ring & 3-ring PAHs; HMW-PAH = eight 4-ring and 5-ring PAHs; Total PAH = sum of LMW and HMW PAHs (NOAA, 1991)

 LMW PAH, HMW PAH Kow = median of analyte specific Kow, Total PAH Kow = mean of LMW, HMW PAH Kow

4 - Sum of Congeners X 2

NA= not applicable

Table A-2.1A. Concentrations of chemical contaminants in surface sediment (0-15 cm) collected in the Derecktor Shipyard/Coddington Cove study area.

ERA investigation.

Class	Analyte[1]	DSY-25	DSY-26	DSY-27	DSY-28	DSY-29[2]	DSY-30	DSY-31	DSY-32	DSY-33	DSY-34	DSY-35	DSY-36	DSY-37	DSY-38	DSY-39	DSY-40	DSY-41
Metals	Arsenic	6.36	9.43	11.60	8.68	12.46	10.30	10.22	10.93	7.39	9.66	3.39	11.21	7.41	8.94	7.58	6.79	11.43
	Cadmium	0.34	0.18	1.03	0.55	1.45	1.20	0.76	0.72	0.19	0.32	0.09	0.40	0.32	0.25	0.18	0.50	0.18
	Chromium	55.00	53.50	103	80.50	86.50	79.25	76.75	84.75	46.50	64.25	24.25	83.25	56.50	66.00	56.50	44.50	36.75
	Copper	23.50	39.25	166	71.75	158	81.25	80.75	66.75	17.25	33.50	1.88	54.00	27.00	28.00	20.00	29.75	9.25
	Lead	35.90	40.40	151	77.70	186	80.00	81.00	125	40.00	47.60	14.00	78.80	56.90	62.20	54.00	42.10	17.00
	Mercury	0.13	0.14	0.59	0.32	0.50	0.47	0.40	0.37	0.13	0.15	0.07	0.38	0.28	0.26	0.15	0.19	0.02
	Nickel	21.00	20.50	43.50	24.25	34.75	27.25	24.75	25.75	18.25	20.50	5.00	25.75	16.75	22.00	17.75	17.25	14.50
	Silver	0.26	0.19	0.69	0.51	0.79	0.74	0.51	0.81	0.24	0.29	0.07	0.56	0.39	0.16	0.26	0.21	0.07
	Zinc	110	102	547	169	393	193	167	201	72.25	106	28.50	144	93.50	109	97.25	100	47.25
	SEM-AVS																	
PAHs	1,6,7-Trimethylnaphthalene	6.19	4.34	7.87	8.41	27.94	19.25	7.90	7.89	2.04	4.43	0.16	6.41	4.74	4.04	4.57	4.66	0.45
	1-Methylnaphthalene	10.93	7.83	20.47	19.85	50.07	55.11	20.42	17.57	5.11	12.70	0.37	16.71	12.63	9.17	9.27	9.41	1.27
	1-Methylphenanthrene	52.56	43.54	61.44	38.57	267	114	32.53	51.57	8.88	18.31	0.50	33.92	39.80	30.93	20.22	38.26	2.22
	2,6-Dimethylnaphthalene	27.20	18.65	38.46	34.23	112	70.71	34.64	43.59	9.91	9.56	1.69	46.60	18.82	18.31	14.31	17.33	2.36
	2-Methylnaphthalene	11.22	13.86	32.72	43.87	73.47	88.19	36.86	32.08	9.66	24.22	0.65	23.00	17.64	13.96	15.17	16.39	2.01
	Acenaphthene	41.74	12.21	23.89	17.27	189	197	17.14	14.29	3.31	8.55	0.23	11.00	7.41	6.53	10.15	16.20	1.71
	Acenaphthylene	75.65	93.84	142	74.63	300	91.94	71.00	131	11.85	28.68	0.61	74.94	34.51	25.06	22.52	95.65	0.77
	Anthracene	302	268	383	183	1220	456	200	298	31.49	64.35	1.60	158	141	94.02	77.19	234	11.10
	Benzo(a)anthracene	328	518	809	294	2700	697	281	388	50.05	101	2.76	222	144	112	97.70	234	13.76
	Benzo(a)pyrene	396	434	924	377	2380	812	421	495	67.85	148	4.14	319	164	120	143	317	18.55
	Benzo(b)fluoranthene																	
	Benzo(e)pyrene	345	365	829	362	1950	773	401	417	63.45	141	5.02	275	140	112	126	333	19.44
	Benzo(g,h,i)perylene	200	201	500	247	1110	452	215	287	50.33	97.60	4.12	195	126	94.65	96.67	184	12.18
	Benzo(k)fluoranthene	877	999	2240	911	5350	1640	1040	1100	155	348	10.95	700	308	260	302	836	47.26
	Biphenyl	6.89	6.66	15.06	12.61	29.91	23.76	14.41	15.37	3.18	6.42	0.42	10.50	5.79	5.70	5.64	6.02	0.66
	Chrysene	485	592	912	364	2800	716	399	491	58.78	128	3.63	287	154	107	120	444	20.65
	Dibenz(a,h)anthracene	60.86	61.34	131	66.60	317	130	62.93	72.22	12.41	26.45	0.92	48.30	28.80	21.03	27.35	52.77	3.18
	Fluoranthene	490	686	801	459	4970	1490	399	535	95.23	208	7.22	345	262	230	216	779	37.83
	Fluorene	44.13	53.89	61.63	31.45	294	177	28.12	25.73	6.57	13.92	0.58	18.02	9.74	6.42	14.73	19.09	2.09
	Indeno(1,2,3-cd)pyrene	195	209	473	223	1020	398	218	264	45.31	93.27	3.15	178	100	80.23	91.28	166	11.44
	Naphthalene	17.98	16.16	41.75	37.54	76.08	136	45.30	42.67	10.87	22.27	0.66	34.06	26.88	23.22	23.68	21.00	1.84
	Perylene	104	133	249	133	611	207	142	150	23.92	61.03	2.11	97.64	53.29	51.09	51.92	78.70	7.31
	Phenanthrene	283	317	335	220	1610	1270	216	182	46.16	110	3.69	138	83.10	67.14	116	304	20.16
	Pyrene	584	740	1950	650	5300	1750	846	917	107	250	6.45	482	362	254	227	1190	49.54
	Low Molecular Weight PAHs	597	539	828	502	2639	1429	509	680	103	213	7.46	433	319	237	217	478	26.49
	High Molecular Weight PAHs	4348	5256	10153	4308	30118	10334	4640	5298	776	1712	54.18	3286	1926	1509	1615	4917	261
	Sum of PAHs	4944	5795	10981	4809	32757	11763	5149	5978	879	1925	61.65	3719	2245	1746	1832	5395	288
PCBs	Total PCBs (Sum Congenersx2)	93.61	98.24	3310	134	546	315	221	201	39.93	64.58	6.70	113	99.90	59.33	58.16	84.13	13.75
Pesticides	Aldrin	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	Hexachlorobenzene	0.08	0.12	0.12	0.06	0.16	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
	Mirex	0.10	0.19	2.59	0.17	0.10	5.03	0.33	0.71	0.10	0.29	0.10	0.37	0.36	0.34	0.10	0.23	0.10
	o,p'-DDE	0.10	1.52	65.22	1.67	4.96	5.66	3.63	0.26	0.63	0.90	0.26	0.25	0.10	0.10	0.71	1.07	0.40
	p,p'-DDE	0.87	0.61	7.00	2.03	6.29	4.44	1.95	2.38	0.42	0.96	0.03	2.60	1.35	1.29	0.73	1.14	0.08
TOC	% TOC	1.78	1.47	3.72	4.01	6.00	3.79	3.84	3.57	1.66	3.18	0.61	3.54	2.21	3.07	2.55	1.47	0.81

Units: Metals=μg/g; PAHs, PCBs and Pesticides=ng/g.
1- TOC value for DSY-29 = average for DSY-29 and DSY-29FD samples; see ERA Table A-1-5.2.

Mean TOC%[1]
2.78

Table A-2.1B. Concentrations of chemical contaminants in surface sediment (0-2 cm) collected in the Derecktor Shipyard/Coddington Cove study area.

Class	Analyte	DSY-1	DSY-2	DSY-3	DSY-4	DSY-5	DSY-6	DSY-7	DSY-8	DSY-9	DSY-10	DSY-11	DSY-12	DSY-13	DSY-14	DSY-15	DSY-16	DSY-17	DSY-18	DSY-19	DSY-20	DSY-21	DSY-22	DSY-23	DSY-24
Metals	Arsenic																								
	Cadmium	0.20	0.15	1.00	0.12	0.22	0.21	0.17	0.19	0.85	0.07	0.31	0.23	0.04	1.60E-03	0.05	0.03	0.04	0.22	0.17	0.25	0.19	0.21	0.21	0.01
	Chromium	95.99	152	195	84.79	106	109	79.30	103	65.30	60.85	132	114	56.46	60.54	72.28	55.45	57.34	107	105	99.23	142	106	98.85	71.90
	Copper	45.52	197	262	62.84	52.29	57.77	27.93	76.01	3.99	12.47	81.46	53.87	18.09	7.75	18.61	6.41	17.23	81.67	66.91	79.68	29.66	51.26	49.44	14.43
	Lead	35.39	181	201	51.35	43.30	48.58	31.70	50.60	14.86	22.13	46.08	45.99	35.20	28.94	42.03	31.53	32.90	60.23	57.82	76.91	41.83	52.53	54.19	39.15
	Mercury																								
	Nickel	38.60	85.28	128	37.41	38.35	40.84	37.41	40.24	33.90	31.42	168	40.40	16.87	9.16	10.13	4.44	5.90	25.36	22.79	23.07	7.91	25.28	23.20	11.74
	Silver	0.60	0.82	1.27	13.78	2.32	1.59	5.41	1.74	0.73	0.56	1.22	1.58	0.06	0.05	0.05	0.05	0.05	0.16	0.40	0.88	0.08	0.12	0.12	0.06
	Zinc	149	593	1231	190	173	175	119	184	58.82	63.84	1104	161	89.48	67.60	83.13	48.32	71.29	163	139	158	175	143	141	98.08
	SEM-AVS																								
PAHs	1,6,7-Trimethylnaphthalene	2.36	10.10	51.69	0	10.33	3.91	4.02	11.00	0	1.01	8.15	0	0	1.61	0	1.82	0	1.01	0	4.30	4.19	7.06	9.73	3.28
	1-Methylnaphthalene	6.84	0.50	9.71	0	1.75	0	3.47	0.12	0	0	10.97	9.85	0	6.92	0	2.36	0	0	0	0	14.95	78.68	35.72	10.82
	1-Methylphenanthrene	27.68	368	441	15.40	42.66	14.03	34.59	81.87	4.33	1.27	51.06	21.94	59.60	4.16	177	21.19	82.13	228	311	421	15.41	28.68	108	9.02
	2,6-Dimethylnaphthalene	6.56	7.55	23.04	0	3.35	0	1.79	1.89	0	0	12.33	7.35	0	0.73	0	0.67	0	0	0	0	3.04	1.18	5.39	3.48
	2-Methylnaphthalene	0	2.47	8.22	0	4.74	0	0	2.37	0	0.74	6.93	0.98	0	11.32	0	1.46	0	0	0	0	20.10	35.18	53.40	14.56
	Acenaphthene	18.26	63.47	193	0	12.70	18.16	18.28	11.93	0	2.29	20.89	10.01	0	1.00	0	1.05	0	14.84	0	17.13	7.12	10.79	21.57	2.20
	Acenaphthylene	58.86	427	867	89.27	26.56	24.65	28.05	37.66	2.74	1.03	57.61	95.69	1.99	8.33	0	2.78	32.21	167	0	64.60	30.23	42.38	65.31	31.85
	Anthracene	201	1330	3360	260	129	203	161	181	18.58	17.37	254	284	59.38	15.76	257	7.83	213	753	799	922	99.90	130	166	38.28
	Benzo(a)anthracene	166	7380	10600	414	378	405	277	562	34.55	26.14	274	185	28.21	40.13	134	14.48	188	898	399	1420	196	272	414	86.15
	Benzo(a)pyrene	164	3320	4710	431	402	488	302	481	49.13	38.47	206	249	26.07	27.85	245	11.76	311	1190	788	1090	110	182	239	54.52
	Benzo(b)fluoranthene	358	10100	9230	646	683	801	399	874	67.28	70.46	381	438	80.42	34.34	324	20.17	477	1890	1050	1500	159	252	318	69.42
	Benzo(e)pyrene	273	5140	5600	443	404	452	303	487	53.22	40.07	257	388	51.55	20.86	221	11.44	265	1020	576	743	88.94	146	187	38.08
	Benzo(g,h,i)perylene	97.41	2070	3060	272	313	355	233	328	19.41	29.52	132	226	41.20	32.57	165	13.71	163	563	260	280	134	215	310	61.29
	Benzo(k)fluoranthene	224	2070	1980	489	248	287	245	294	55.60	24.16	245	347	130	13.19	230	32.56	243	899	791	2300	47.04	75.13	118	106
	Biphenyl	5.01	12.81	40.77	0.62	11.03	8.90	1.66	11.37	0	0	18.53	13.32	0	1.85	0	1.50	0	9.37	0	0	5.62	9.36	10.93	2.67
	Chrysene	406	4980	6390	764	479	603	376	624	70.60	47.47	538	523	140	27.18	444	13.57	387	1460	1170	1580	122	193	232	57.66
	Dibenz(a,h)anthracene	21.20	784	1460	93.38	85.16	89.09	52.05	118	14.96	9.34	28.43	35.93	9.31	11.72	20.50	3.62	64.18	243	39.28	56.80	43.99	63.36	117	16.11
	Fluoranthene	1050	12000	13600	886	644	788	831	818	114	94.27	1320	817	117	66.58	464	34.36	477	1590	1830	5850	325	550	827	224
	Fluorene	42.73	439	859	25.15	42.69	55.07	53.58	53.58	4.86	0.92	74.94	48.75	0	8.49	0	4.96	24.42	92.44	0	216	29.36	78.14	63.94	18.21
	Indeno(1,2,3-cd)pyrene	99.85	1720								18.33	132	168	36.45	25.85	143	9.44	143	529	255	276	99.71	164	226	45.89
	Naphthalene	0.27	1.97	2.94	0	8.02	3.82	0	3.53	0	1.90	11.75	12.71	0	5.15	0	2.59	0	0	0	0	9.13	2.98	15.99	1.65
	Perylene	57.17	1050	1336	165	147	203	116	203	17.40	22.57	95.53	131	41.60	16.32	130	12.63	90.70	311	244	300	54.42	95.61	118	26.20
	Phenanthrene	305	3990	4890	217	224	264	385	309	41.14	21.15	392	263	41.00	52.73	112	18.25	201	627	550	1400	171	548	478	180
	Pyrene	794	9390	10100	710	518	601	681	758	79.30	93.92	990	723	113	67.98	496	41.29	409	1640	1550	3820	373	514	823	198
	Low Molecular Weight PAHs	369	2662	5856	391	293	332	307	396	30.51	26.53	528	504	121	65.32	434	48.21	351	1266	1110	1654	233	437	551	136
	High Molecular Weight PAHs	4013	63994	72956	5532	4526	5336	4198	5856	617	536	4991	4494	873	436	3129	237	3418	12860	9212	20406	1923	3271	4409	1162
	Sum of PAHs	4383	66656	78812	5922	4818	5668	4505	6252	647	562	5519	4998	994	501	3563	285	3769	14126	10322	22060	2156	3708	4960	1298
PCBs	Total PCBs (Sum Congenersx2)	67.58	209	733	195	105	132	73.36	148	28.15	11.73	658	176	22.32	22.98	54.84	9.40	244	293	217	367	92.31	178	150	25.87
Pesticides	Aldrin	0	0.06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.09	0	0.18	0	0	0	0
	Hexachlorobenzene	0	0.24	0.17	0	0	0	0	0.06	0	0	0	0.06	0	0	0.06	0	0.07	0.10	0.10	0.12	0.24	0.08	1.47	0
	Mirex	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.17	0.39	0.23	0.32	0.09	0.28	0.22	0
	o,p'-DDE	0.98	5.71	3.81	4.03	2.92	2.59	1.54	2.10	0.38	0.74	8.71	2.43	0.75	0.42	1.57	0	0.65	4.34	2.39	6.26	1.18	-2.53	1.58	0.30
	p,p'-DDE	0.18	3.13	13.61	0	1.75	2.12	3.58	1.82	0.78	3.46	1.45	2.51	0.63	0.40	1.20	0.36	0.44	0	1.79	0	0.76	2.02	3.71	0.47
TOC	% TOC	2.06	1.30	2.63	3.17	6.70	4.37	2.67	4.63	1.51	1.53	6.17	5.33	0.64	1.01	2.06	0.26	1.01	2.95	4.21	3.29	1.15	2.94	2.86	1.40

Units: Metals=µg/g; PAHs, PCBs and Pesticides=ng/g.
1 - Quinn et al., (1994).

Mean TOC%
2.74

Table A-2.1C. Concentrations of PCB congeners and calculation of Total PCBs in surface sediment (0-15 cm) collected in the Derecktor Shipyard/Coddington Cove study area.

ERA investigation.

Class	Analyte	DSY-25	DSY-26	DSY-27	DSY-28	DSY-29	DSY-30	DSY-31	DSY-32	DSY-33	DSY-34	DSY-35	DSY-36	DSY-37	DSY-38	DSY-39	DSY-40	DSY-41
PCBs	PCB101	6.48	5.72	220	5.51	16.70	19.00	12.75	14.32	1.74	2.87	0.51	6.73	6.36	2.80	2.09	3.93	0.52
	PCB105	1.75	1.82	137	2.04	6.61	7.04	4.39	2.63	0.56	0.79	0.04	1.37	1.41	0.58	0.54	1.55	0.11
	PCB118	5.02	6.20	242	7.09	18.38	19.56	13.74	11.28	2.34	3.51	0.14	6.11	5.30	2.49	2.25	4.85	0.36
	PCB128	1.37	1.34	73.00	1.89	5.14	6.25	3.07	3.14	0.55	0.87	0.04	1.86	1.77	0.83	0.60	1.42	0.23
	PCB138	5.92	7.21	265	10.86	27.04	26.57	16.11	15.16	2.89	4.86	0.14	9.08	7.39	5.13	4.14	7.10	0.59
	PCB153	4.37	6.16	174	9.97	22.80	20.54	14.43	12.23	2.72	4.81	0.21	8.00	5.85	4.46	4.42	5.87	0.52
	PCB170	0.89	1.53	44.16	3.13	7.25	6.29	3.83	2.30	0.80	1.39	0.13	1.75	1.40	1.34	1.52	1.71	0.17
	PCB18	0.67	0.79	8.36	0.45	0.68	1.30	1.34	0.91	0.26	0.24	0.02	0.49	0.34	0.68	0.25	0.34	0.27
	PCB180	1.86	2.74	53.17	5.77	13.79	11.57	6.80	4.52	1.50	2.46	0.28	3.20	2.54	2.52	2.77	3.46	0.33
	PCB187	1.81	1.92	25.82	3.94	8.54	7.02	4.66	4.26	1.19	1.89	0.08	3.40	2.40	1.91	1.85	2.26	0.29
	PCB195	0.16	0.51	2.93	0.96	3.83	1.01	1.80	0.53	0.19	0.49	0.09	0.32	0.18	0.27	0.57	0.56	0.17
	PCB206	1.52	2.13	7.45	3.12	17.39	6.27	4.33	2.68	1.12	1.81	0.44	2.23	2.79	1.12	1.93	2.39	0.69
	PCB209	0.91	2.04	5.05	3.99	105	6.82	4.50	4.34	1.29	1.98	0.38	2.40	3.10	1.55	2.07	2.84	0.79
	PCB28	2.06	1.26	12.92	1.50	1.66	2.54	3.67	2.61	0.57	0.88	0.24	1.27	0.76	0.56	0.79	0.67	0.20
	PCB44	2.04	1.98	65.05	1.47	3.94	4.49	3.69	2.59	0.54	0.85	0.36	1.12	1.05	0.47	0.93	0.80	0.52
	PCB52	3.21	3.62	130	2.85	9.69	9.22	7.23	4.43	0.96	1.37	0.51	1.37	2.10	0.71	1.20	1.47	0.73
	PCB66	6.16	1.63	180	1.65	3.87	0.94	2.72	11.28	0.46	0.88	0.12	5.36	4.77	2.08	0.90	0.71	0.24
	PCB8	0.59	0.53	5.64	0.66	0.60	1.22	1.43	1.23	0.29	0.33	0.06	0.60	0.46	0.17	0.26	0.15	0.17
	SUMPCB	46.81	49.12	1650	66.85	273	158	110	100	19.97	32.29	3.35	56.64	49.95	29.67	29.08	42.07	6.88
	TOTPCB	93.61	98.24	3310	134	546	315	221	201	39.93	64.58	6.70	113	99.90	59.33	58.16	84.13	13.75
TOC	% TOC	1.79	1.47	3.73	4.01	6.09	3.79	3.84	3.57	1.66	3.18	0.61	3.55	2.21	3.08	2.55	1.48	0.81

Units: PCBs =ng/g dry wt.
SUMPCB = Sum of congener concentrations.
TOTPCB = Total PCBs - SUMPCB x 2.

Table A-2.2. Geotechnical characteristics of reference sediments
in Narragansett Bay, Rhode Island.

Site	Station	Depth	%Sand	%Silt	%Clay	%TOC
MCL	JCC-D1	SUR	92.14	6.67	1.19	0.84
MCL	JCC-M1	SUR	90.49	7.63	1.88	0.85
MCL	JCC-S1	SUR	75.02	10.30	14.67	2.07
DSY	JPC-1	SUR	88.10	11.90	0	1.06
DSY	JPC-2	SUR	66.65	33.17	0.18	1.71
AH	JSC-D1	SUR	99.88	0.12	3.74E-05	0.45
AH	JSC-V1	SUR	97.49	2.50	0.02	0.67
AH	JSC-W1	SUR	94.12	5.88	0	0.65
AH	PCC-D1	SUR	99.99	6.21E-03	1.87E-05	0.39
AH	PCC-V1	SUR	86.52	13.43	0.05	1.60
AH	PCC-W1	SUR	97.02	2.94	0.04	1.36
		Mean:	89.77	8.60	1.64	1.06
		S.D.	10.53	9.32	4.37	0.55

MCL = McAllister Point Landfill ERA (SAIC and URI, 1997a)
AH = Allen Harbor Landfill ERA (SAIC, 1996)
DSY= Derecktor Shipyard ERA (SAIC and URI, 1997b)
Data Sources: SAIC, 1996 (JSC/PCC - Allen Harbor ERA reference locations),
Appendix A-1-1 (sediment concentrations) and A-1-3 (porewater concentrations);
SAIC and URI, 1997a (JCC - McAllister Point ERA reference location),
Appendix A-1-1-1 (sediment organic chemistry), A-1-2-1 (sediment metals chemistry),
and A-1-2-3 (porewater metals chemistry); and
SAIC and URI, 1997b (JPC/CHC - Derecktor Shipyard ERA reference locations),
Appendix A-1-1 (sediment chemistry) and A-1-2 (elutriate chemistry).

Table A-2.3. Lipid and solids content data for species collected for the Derecktor Shipyard ERA.

FIELDID	Solids content (g dry/g live wt)						Lipid content (%)				
	CN/MF	HC	IBM	LOB	MM	PM	CN	IBM	LOB	MM	PM
DSY-24			0.09					5.41			
DSY-25			0.09	0.15				4.44	2.53		
DSY-26	0.15		0.13				9.09	5.40			
DSY-27			0.13	0.15				6.77	2.33		
DSY-28	0.17		0.11	0.14			11.40	5.40	2.83		
DSY-29	0.16			0.14			8.69		2.44		
DSY-31						0.09					2.79
DSY-32						0.11					3.25
DSY-33				0.17		0.09			2.51		3.21
DSY-34						0.10					3.69
DSY-35		0.14	0.14	0.15		0.12		5.00	2.36	2.01	2.40
DSY-36	0.15		0.12	0.14		0.07	8.37	5.37	1.79		2.40
DSY-37						0.03					1.10
DSY-38				0.11		0.10			2.57		4.03
DSY-39				0.15					2.02		
DSY-40			0.14					6.31			
DSY-41		0.15				0.12				2.14	2.11
JPC-1	0.17		0.11	0.12	0.18	0.09	12.47	6.07	2.53	2.59	0.93
CHC-1	0.15		0.10	0.13			11.83	4.28	2.28		
Species Mean	0.16	0.15	0.11	0.14	0.18	0.09	10.31	5.45	2.38	2.25	2.59
N	6.00	2.00	10.00	11.00	1.00	10.00	6.00	10.00	11.00	3.00	10.00
Mean % solids/lipid content	0.14						4.59				

CN = cunner, HC = hard clam, IBM = indigenous blue mussels, LOB = lobster, MM = *Mercenaria mercenaria*, PM = *Pitar morrhuana*, MF = mummichog.

Table A-2.4. Concentrations of selected contaminants in tissues of prey in the Derecktor Shipyard/Coddington Cove study area available for consumption by avian predators and subsistence fishermen[1].

Class	Analyte	DSY-24-IBM	DSY-25-IBM	DSY-25-LOB	DSY-28-CN	DSY-26-DM	DSY-26-IBM	DSY-27-IBM	DSY-27-LOB	DSY-28-CN	DSY-28-DM	DSY-28-IBM	DSY-28-LOB	DSY-29-CN	DSY-29-DM	DSY-29-LOB	DSY-31-DM	DSY-31-PM	DSY-32-PM	DSY-33-DM	DSY-33-LOB	DSY-33-PM	DSY-34-PM	DSY-35-IBM	DSY-35-LOB
MET	Arsenic	10.22	12.56	28.84	3.64	5.32	8.22	6.68	17.19	4.89	16.84	2.69		7.67	8.94	28.56	5.21	9.36	4.92	12.43	22.25	5.88	9.62	6.23	16.23
MET	Cadmium	1.86	1.21	0.36	0.83	0.94	0.73	0.77	0.28	1.09	0.77	0.62		1.15	0.81	0.47	0.54	0.78	0.59	0.93	0.16	0.68	0.71	0.73	0.58
MET	Chromium	3.15	3.00	1.66	1.39	2.16	2.44	2.86	2.11	0.94	2.38	2.54		1.18	2.02	1.71	2.29	1.98	1.74	2.53	1.99	1.85	2.13	2.22	2.16
MET	Copper	4.16	11.94	152	17.48	13.28	7.69	14.80	167	15.30	10.98	1.13		21.81	6.32	100	8.91	14.38	10.92	8.44	60.35	8.64	10.14	7.50	128
MET	Lead	5.81	3.00E-04	0.16	0.79	1.36	3.00E-04	3.02	0.07	3.00E-04	3.00E-04	3.00E-04		0.91	0.94	0.22	1.34	1.74	2.77	1.47	0.47	3.00E-04	1.66	1.75	0.76
MET	Mercury	0.28	0.17	0.26	0.13	0.16	0.12	0.15	0.45	0.10	0.13	0.14		0.17	0.17	0.29	0.15	0.14	0.15	0.10	0.23	0.12	0.12	0.17	0.27
MET	Nickel	5.44	3.43	1.52	1.02	1.82	3.00E-04	4.74	1.20	1.29	4.87	3.00E-04		1.74	2.87	1.74	2.07	3.99	2.17	1.74	1.74	3.00E-04	2.11	3.00E-04	0.91
MET	Silver	1.00E-04	1.00E-04	5.47	0.52	1.00E-04	1.00E-04	1.00E-04	6.97	0.31	1.18	1.00E-04		1.00E-04	1.00E-04	5.84	1.00E-04	1.00E-04	1.38	1.00E-04	3.43	1.00E-04	1.00E-04	1.00E-04	5.54
MET	Zinc	76.33	112	87.87	41.51	103	90.97	142	113	26.47	95.25	121		28.54	74.94	129	164	87.34	113	122	105	102	92.42	130	110
MET	SEM:AVS																								
PAH	1,6,7-Trimethylnaphthalene	3.76	3.76	3.76	3.76	3.76	3.76	19.16	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.78	3.76	3.76	3.76	3.76	3.76	3.76
PAH	1-Methylnaphthalene		14.87	5.67	5.67	5.67	5.67	5.67	5.27	12.46	5.67	5.67	13.26	32.77	5.67	9.85	5.67	5.67	5.67	5.67	11.58	5.67	5.67	5.67	5.67
PAH	1-Methylphenanthrene	8.52	26.00	9.05	9.05	9.05	36.34	49.75	44.61	1210	9.05	9.05	83.72	32.56	8.05	78.83	9.05		60.78	9.05	86.91	158	125	9.89	9.05
PAH	2,6-Dimethylnaphthalene	43.87	13.81	5.25	5.25	26.95	16.09	24.70	5.25	5.25	5.25	5.25	12.56	5.25	47.15	5.25	5.25		5.25	5.25	5.25	5.25	5.25	19.25	5.25
PAH	2-Methylnaphthalene		28.07	9.40	9.40	9.40	9.40	9.40	7.65	14.12	9.40	9.40	12.28	23.95	9.40	14.88	9.40	9.40	9.40	9.40	13.77	9.40	9.40	19.25	9.40
PAH	Acenaphthene	2.65	15.66	2.65	28.90	67.31	2.65	32.54	45.70	2.65	2.65	2.65	2.65	39.49	151	2.65	2.65	2.65	2.65	2.65	2.65	2.83	2.65	2.65	2.65
PAH	Acenaphthylene	11.51	74.50	2.89	2.89	49.52	89.51	59.11	2.89	3.91	2.89	34.78	2.89	2.89	31.21	2.89	2.89	2.89	13.52	2.89	2.89	2.89	2.89	2.89	2.89
PAH	Anthracene	17.73	184	8.00	8.00	64.97	237	167	8.21	5.95	23.68	68.19	4.15	6.15	40.24	8.00	33.41	30.36	27.53	8.00	8.00	13.37	19.82	25.48	3.11
PAH	Benzo(a)anthracene	15.25	281	3.36	12.70	75.61	1040	290	29.01	42.87	42.26	71.77	24.30	3.36	53.66	3.36	58.92	133	79.21	3.36	3.36	35.25	46.15	31.11	3.36
PAH	Benzo(a)pyrene	7.91	115	3.62	19.10	3.62	548	73.10	28.73	1.58	3.62	33.86	24.95	11.99	3.62	13.09	3.62	44.99	42.60	3.62	3.62	22.19	22.44	3.62	3.62
PAH	Benzo(b)fluoranthene	43.30	551	6.20	48.20	120	2310	393	60.96	6.20	76.68	128	58.37	26.97	70.97	23.65	89.30	129	84.37	6.20	22.97	35.59	49.65	66.03	6.20
PAH	Benzo(e)pyrene	36.94	274	3.90	21.70	88.63	820	234	20.01	3.90	60.79	108	20.12	3.90	59.32	9.86	45.64	3.90	3.90	11.89	3.90	3.90	52.26	3.90	
PAH	Benzo(g,h,i)perylene	20.84	48.06	1.56	19.50	1.56	148	29.20	9.21	1.56	1.56	1.56	11.71	1.56	1.56	12.67	1.56	25.77	34.22	1.56	1.56	13.25	11.20	14.15	1.56
PAH	Benzo(k)fluoranthene																								
PAH	Biphenyl	5.70	11.63	5.70	14.20	5.70	5.70	12.89	5.70	7.40	5.70	5.70	8.08	6.31	5.70	5.70	5.70	5.70	5.70	5.70	14.24	5.70	5.70	5.70	5.70
PAH	Chrysene	20.76	301	5.26	15.40	68.45	626	297	30.79	32.18	29.40	85.89	38.59	5.26	37.35	5.26	38.26	67.37	59.73	5.26	5.26	42.27	24.42	40.24	5.26
PAH	Dibenz(a,h)anthracene	7.92	13.54	0.49	0.49	0.49	49.67	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49
PAH	Fluoranthene	59.94	741	100	31.80	343	1310	1160	86.46	24.84	116	248	72.90	38.51	171	39.03	119	179	152	87.34	32.14	57.16	73.39	105	32.88
PAH	Fluorene	6.88	29.69	1.95	24.10	1.95	33.37	39.15	1.95	37.82	1.95	25.14	1.95	25.80	1.95	14.92	1.95	1.95	1.95	1.95	1.95	5.19	5.21	11.62	1.95
PAH	Indeno(1,2,3-cd)pyrene	11.87	35.47	1.54	14.20	1.54	121	26.78	8.64	1.54	1.54	1.54	1.54	1.54	1.54	10.57	1.54	20.43	26.87	1.54	1.54	8.78	7.89	10.38	1.54
PAH	Naphthalene		136	1.68	1.68	1.68	183	1.68	12.00	1.68	1.68	1.68	12.00	1.68	1.68	19.42	1.68	1.68		1.68	35.20	1.68	1.68	1.68	
PAH	Perylene		81.96	3.50	3.50	3.50	184		10.79	2.83	3.50		11.89	3.23	3.50	3.50	3.50			10.34	3.50	3.50	5.32	3.91	3.50
PAH	Phenanthrene	23.91	152	9.45	40.30	77.74	227	272	20.07	30.76	43.94	114	32.15	47.32	47.36	28.17	40.99	23.80	28.75	9.45	19.84	14.31	35.14	41.71	13.19
PAH	Pyrene	48.23	505	85.64	21.30	271	1040	819	93.81	24.76	117	175	124	36.39	163	69.49	117	197	182	88.38	53.14	55.67	77.45	78.56	24.59
PAH	LMW PAHs	62.67	619	36.02	115	273	782	551	85.31	140	86.18	256	68.07	147	282	90.93	92.96	72.72	85.49	36.02	84.30	49.66	76.79	95.41	23.78
PAH	HMW PAHs	159	1955	199	101	762	4614	2639	269	127	309	613	285	96.01	429	131	337	621	516	188	98.01	213	244	259	70.20
PAH	Total PAHs	384	3630	186	322	1250	8020	3970	508	1500	510	1090	565	331	872	344	543	850	812	176	302	470	501	505	74.00
PCB	Total PCBs	615	528	468	2200	1780	831	1150	749	3970	689	802	961	3170	869	355	786	951	367	639	409	524	311	696	317
PST	Aldrin	0.15	0.15	0.15	0.40	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
PST	Hexachlorobenzene	0.15	0.15	0.23	0.15	40.52	0.15	0.15	1.12	0.15	0.15	0.15	1.16	0.15	2.30	1.16	0.16	0.97	0.34	0.15	0.49	1.14	0.52	0.15	1.26
PST	Mirex	3.55	0.46	0.75		5.32	2.24	2.02	1.24		3.02	3.69	0.65		2.06	1.07	3.66	0.48	1.06	2.70	1.55	0.86	0.58	1.32	0.59
PST	o,p'-DDE	4.23	4.77	0.15	3.62	11.43	5.64	8.95	0.15	5.47	13.00	5.81	0.15	3.20	10.75	0.15	15.18	3.83	0.15	10.26	0.15	0.15	0.15	3.94	0.15
PST	p,p'-DDE	7.85	4.85	5.88	29.10	12.55	7.56	11.89	8.43	44.83		7.30	9.80	67.05	15.68	6.31	14.54	2.99	2.52	12.96	6.64	3.80	1.52	12.15	4.89
lipid	%lipid	13.52	25.04	3.00	10.56	32.71	19.88	977	3.00	33.45	11.00	49.08	3.00	34.52	18.05	3.00	9.50	47.91		20.56	3.00	53.80	39.25	9.18	3.00

units: metals (µg/g); organics (ng/g dry wt).

1 - Tissue concentration data as reported in Derecktor Shipyard ERA, Appendix A-1-3 (SAIC and URI, 1997).

Table A-2.4 (continued). Concentrations of selected contaminants in tissues of prey in the Derecktor Shipyard/Coddington Cove study area available for consumption by avian predators and subsistence fishermen[1].

Class	Analyte	DSY-35-MM	DSY-35-PM	DSY-36-CN	DSY-36-IBM	DSY-36-LOB	DSY-36-PM	DSY-37-PM	DSY-38-DM	DSY-38-LOB	DSY-39-PM	DSY-39-DM	DSY-39-LOB	DSY-40-DM	DSY-40-IBM	DSY-41-MM	DSY-41-PM
MET	Arsenic	6.42	8.47	3.59	6.15	19.84	7.43	7.43	6.08	26.08	6.08	8.94	18.66	5.96	5.27	7.46	2.16
MET	Cadmium	0.64	0.66	0.97	0.39	3.00E-04	0.83	0.64	0.62	0.49	0.59	0.32	0.30	0.61	0.63	0.90	0.72
MET	Chromium	2.38	2.01	0.86	2.84	1.97	2.46	1.73	2.62	1.95	1.84	2.99	1.64	2.71	2.23	1.76	1.94
MET	Copper	6.42	8.43	15.54	7.04	49.16	11.96	8.93	11.44	165	10.44	8.59	197	6.32	6.99	13.15	11.90
MET	Lead	3.00E-04	1.66	0.97	3.00E-04	0.34	2.19	2.97	1.93	0.26	3.00E-04	3.00E-04	0.18	2.97	2.44	1.61	3.00E-04
MET	Mercury	0.12	0.10	0.15	0.19	0.33	0.15	0.15	0.13	0.33	0.17	0.14	0.41	0.13	0.17	0.12	0.15
MET	Nickel	2.92	1.55	1.43	4.33	1.46	1.87	1.57	2.91	1.88	3.00E-04	3.34	1.46	3.43	3.00E-04	3.00E-04	1.88
MET	Silver	1.00E-04	1.00E-04	1.00E-04	1.00E-04	2.87	1.00E-04	0.65	1.72	6.10	1.00E-04	0.98	0.82	1.00E-04	1.00E-04	1.26	1.00E-04
MET	Zinc	111	125	54.89	84.56	115	121	106	89.39	171	131	131	129	117	105	65.75	83.67
MET	SEM:AVS																
PAH	1,6,7-Trimethylnaphthalene	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76
PAH	1-Methylnaphthalene	5.67	5.67				5.67			5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67
PAH	1-Methylphenanthrene	4.29	47.09	209	6.79	9.05	120	9.05	9.05	9.05	75.52	9.05	9.05	9.05	9.05	6.68	78.66
PAH	2,6-Dimethylnaphthalene	5.25	5.25	5.25	4.56	5.25	5.25	5.25	6.36	5.25	5.25	13.09	5.25	32.65	5.25	5.25	5.25
PAH	2-Methylnaphthalene	9.40	9.40				9.40			9.40	9.40	9.40	9.40	9.40	9.40	9.40	9.40
PAH	Acenaphthene	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	5.58	67.41	2.65	131	2.65	6.53	6.44
PAH	Acenaphthylene	2.89	2.89	2.89	15.30	2.89	2.89	2.89	11.89	2.89	5.40	32.51	2.89	49.67	22.64	4.56	8.54
PAH	Anthracene	8.00	6.60	8.00	29.00	5.29	28.98	10.14	11.90	2.84	10.66	8.00	1.80	40.94	34.15	10.91	19.67
PAH	Benzo(a)anthracene	15.72	21.53		30.26	3.36	66.19	55.98	14.79	3.36	45.70	17.76	3.36	42.12	24.88		41.39
PAH	Benzo(a)pyrene	6.97	16.15	3.62	12.53	3.62	32.32	23.14	8.07	3.62	20.67	3.62	3.62	3.62	6.24	11.08	17.34
PAH	Benzo(b)fluoranthene	9.17	16.37	6.20	70.95	30.77	90.62	58.08	32.66	6.20	40.49	6.20	6.20	6.20	55.47	13.26	22.82
PAH	Benzo(e)pyrene	1.81	3.70	3.90	48.57	3.90	3.90	8.20	30.75	3.90	3.90	44.38	3.90	48.57	47.00	3.05	3.00
PAH	Benzo(g,h,i)perylene	1.56	1.56	1.56	10.06	1.56	14.62	26.35	1.56	1.56	12.83	23.08	1.56	1.56	1.56	3.71	1.56
PAH	Benzo(k)fluoranthene																
PAH	Biphenyl	5.70	5.70	5.70	5.70	5.70	5.70	5.70	5.70	5.70	5.70	5.70	5.70	5.70	5.70	5.70	5.70
PAH	Chrysene	6.82	11.18		40.52	5.26	51.24	37.63	14.40	5.26	27.97	19.70	5.26	22.76	29.49		31.39
PAH	Dibenz(a,h)anthracene	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	33.15	0.49	0.49	0.49	0.49	0.49
PAH	Fluoranthene	47.51	69.25	18.44	105	38.65	124	74.79	38.98	16.55	43.50	40.91	9.23	144	105	68.50	79.70
PAH	Fluorene	2.89	5.49	19.96	5.01	1.95	1.95	1.95	1.95	1.95	4.74	1.95	1.95	1.95	14.34	3.82	7.95
PAH	Indeno(1,2,3-cd)pyrene	1.54	1.54	1.54	5.99	1.54	10.89	1.54	1.54	1.54	9.15	27.86	1.54	1.54	1.54	1.54	1.54
PAH	Naphthalene	1.68	1.68				1.68			1.68	1.68	1.68	1.68	1.68	15.08	1.68	1.68
PAH	Perylene	12.61	16.13	10.44		3.50	16.58	25.61	1.44	3.50	4.05	3.50	3.50	3.50		12.41	13.51
PAH	Phenanthrene	18.55	28.29	18.65	28.31	18.54	31.69	27.39	18.48	10.06	9.19	9.45	7.46	88.90	59.34	13.31	18.35
PAH	Pyrene	35.55	54.92	48.77	85.29	43.14	116	83.17	43.21	9.04	43.25	43.31	10.56	124	81.47	65.47	83.17
PAH	LMW PAHs	46.08	57.00	52.14	60.27	31.32	90.23	45.02	46.87	31.46	46.65	130	27.82	303	158	60.22	70.03
PAH	HMW PAHs	113	174	72.31	274	94.52	390	275	120	38.32	182	159	32.52	337	248	146	253
PAH	Total PAHs	162	297	326	498	136	704	430	233	38.00	359	363	29.00	704	495	223	428
PCB	Total PCBs	159	484	3130	895	840	493	427	549	291		461	643	556	912	251	274
PST	Aldrin	0.15	0.15	0.97	0.15	0.15	0.15		0.15	0.15		0.15	0.15	0.15	0.15	0.15	0.15
PST	Hexachlorobenzene	0.15	0.71	0.15	0.15	0.42	2.82		0.67	0.58		0.93	0.63	0.48	0.15	0.15	0.58
PST	Mirex		0.66		2.94	0.36	0.41	0.20	5.54	0.30		3.21	0.81	2.24	2.83		0.40
PST	o,p'-DDE	1.11	0.16	1.84	4.65	3.59	2.80	2.09	7.09	0.15		8.84	7.09	5.42	5.69	0.15	1.82
PST	p,p'-DDE	1.97	4.75	53.56	8.16	4.10	2.88	2.93	8.84	7.06		9.82	2.39	9.96	10.37	4.33	1.81
lipid	%lipid	39.10		12.57	35.48	3.00	67.14		8.32	3.00		9.66	3.00	3.00	3.00	31.70	30.61

units: metals (μg/g); organics (ng/g dry wt).
1 - Tissue concentration data as reported in Derecktor Shipyard ERA, Appendix A-1-3 (SAIC and URI, 1997).

Table A-3.1A. Equilibrium-partitioning calculated concentrations of organic contaminants in sediment porewaters from the Derecktor Shipyard/Coddington Cove study area[1].

Class	Analyte[3,4,5,6]	LogKoc[2]	DSY-25	DSY-26	DSY-27	DSY-28	DSY-29	DSY-30	DSY-31	DSY-32	DSY-33	DSY-34	DSY-35	DSY-36	DSY-37	DSY-38	DSY-39	DSY-40	DSY-41
MET	Arsenic																		
MET	Cadmium																		
MET	Chromium																		
MET	Copper																		
MET	Lead																		
MET	Mercury																		
MET	Nickel																		
MET	Silver																		
MET	Zinc																		
MET	SEM:AVS	NA	-21.70	-2.89	-164.35	-55.48	-175.59	-19.50	-47.27	-14.51	1.07	-28.09	-0.32	-35.50	0.38	-27.87	-19.24	-16.62	-3.21
PAH	1,6,7-Trimethylnaphthalene	4.53	0.01	8.68E-03	6.22E-03	6.16E-03	0.01	0.01	6.04E-03	6.49E-03	3.62E-03	4.09E-03	7.80E-04	5.32E-03	6.30E-03	3.86E-03	5.26E-03	9.32E-03	1.63E-03
PAH	1-Methylnaphthalene	3.90	0.08	0.07	0.07	0.06	0.10	0.18	0.07	0.06	0.04	0.05	7.53E-03	0.06	0.07	0.04	0.05	0.08	0.02
PAH	1-Methylphenanthrene	4.99	0.03	0.03	0.02	9.75E-03	0.05	0.03	8.59E-03	0.01	5.42E-03	5.84E-03	8.35E-04	9.72E-03	0.02	0.01	8.04E-03	0.03	2.77E-03
PAH	2,6-Dimethylnaphthalene	4.53	0.04	0.04	0.03	0.03	0.06	0.05	0.03	0.04	0.02	8.83E-03	8.14E-03	0.04	0.03	0.02	0.02	0.03	8.56E-03
PAH	2-Methylnaphthalene	3.90	0.08	0.12	0.11	0.14	0.15	0.29	0.12	0.11	0.07	0.10	0.01	0.08	0.10	0.06	0.07	0.14	0.03
PAH	Acenaphthene	3.85	0.33	0.12	0.09	0.06	0.44	0.73	0.06	0.06	0.03	0.04	5.24E-03	0.04	0.05	0.03	0.06	0.15	0.03
PAH	Acenaphthylene	3.98	0.44	0.67	0.40	0.19	0.52	0.25	0.19	0.38	0.07	0.09	0.01	0.22	0.16	0.09	0.09	0.68	9.92E-03
PAH	Anthracene	4.47	0.57	0.61	0.35	0.15	0.68	0.40	0.18	0.28	0.06	0.07	8.81E-03	0.15	0.21	0.10	0.10	0.54	0.05
PAH	Benzo(a)anthracene	5.60	0.05	0.09	0.05	0.02	0.11	0.05	0.02	0.03	7.51E-03	7.91E-03	1.13E-03	0.02	0.02	9.06E-03	9.55E-03	0.04	4.23E-03
PAH	Benzo(a)pyrene	6.01	0.02	0.03	0.02	9.28E-03	0.04	0.02	0.01	0.01	4.03E-03	4.57E-03	6.70E-04	8.89E-03	7.30E-03	3.85E-03	5.53E-03	0.02	2.26E-03
PAH	Benzo(b)fluoranthene	6.09	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PAH	Benzo(e)pyrene	6.01	0.02	0.02	0.02	8.91E-03	0.03	0.02	0.01	0.01	3.77E-03	4.37E-03	8.11E-04	7.65E-03	6.22E-03	3.59E-03	4.87E-03	0.02	2.37E-03
PAH	Benzo(g,h,i)perylene	6.59	2.91E-03	3.55E-03	3.48E-03	1.60E-03	4.80E-03	3.09E-03	1.45E-03	2.08E-03	7.86E-04	7.95E-04	1.75E-04	1.43E-03	1.48E-03	7.09E-04	9.83E-04	3.24E-03	3.90E-04
PAH	Benzo(k)fluoranthene	6.09	0.04	0.05	0.05	0.02	0.07	0.03	0.02	0.02	7.52E-03	8.80E-03	1.44E-03	0.02	0.01	6.80E-03	9.53E-03	0.05	4.69E-03
PAH	Biphenyl	3.89	0.05	0.06	0.05	0.04	0.06	0.08	0.05	0.06	0.02	0.03	8.89E-03	0.04	0.03	0.02	0.03	0.05	0.01
PAH	Chrysene	5.60	0.07	0.10	0.06	0.02	0.12	0.05	0.03	0.03	8.83E-03	0.01	1.49E-03	0.02	0.02	8.70E-03	0.01	0.08	6.35E-03
PAH	Dibenz(a,h)anthracene	6.58	9.06E-04	1.11E-03	9.35E-04	4.40E-04	1.40E-03	9.10E-04	4.34E-04	5.36E-04	1.98E-04	2.21E-04	4.01E-05	3.62E-04	3.45E-04	1.82E-04	2.84E-04	9.52E-04	1.04E-04
PAH	Fluoranthene	5.03	0.26	0.43	0.20	0.11	0.77	0.36	0.10	0.14	0.05	0.06	0.01	0.09	0.11	0.07	0.08	0.49	0.04
PAH	Fluorene	4.14	0.18	0.27	0.12	0.06	0.36	0.34	0.05	0.05	0.03	0.03	6.90E-03	0.04	0.03	0.02	0.04	0.09	0.02
PAH	Indeno(1,2,3-cd)pyrene	6.54	3.19E-03	4.13E-03	3.69E-03	1.61E-03	4.93E-03	3.05E-03	1.65E-03	2.14E-03	7.92E-04	8.51E-04	1.50E-04	1.46E-03	1.32E-03	7.59E-04	1.04E-03	3.27E-03	4.10E-04
PAH	Naphthalene	3.30	0.50	0.55	0.56	0.47	0.63	1.79	0.59	0.59	0.33	0.35	0.05	0.48	0.61	0.38	0.46	0.71	0.11
PAH	Perylene	5.95	6.59E-03	0.01	7.55E-03	3.75E-03	0.01	6.18E-03	4.16E-03	4.76E-03	1.63E-03	2.17E-03	3.91E-04	3.11E-03	2.72E-03	1.88E-03	2.30E-03	6.04E-03	1.02E-03
PAH	Phenanthrene	4.47	0.54	0.73	0.30	0.19	0.90	1.13	0.19	0.17	0.09	0.12	0.02	0.13	0.13	0.07	0.15	0.70	0.08
PAH	Pyrene	5.02	0.31	0.48	0.50	0.15	0.84	0.44	0.21	0.24	0.06	0.07	0.01	0.13	0.16	0.08	0.08	0.77	0.06
PAH	LMW PAHs		2.40	2.58	1.70	1.20	3.44	5.02	1.34	1.44	0.70	0.79	0.13	1.07	1.22	0.74	0.99	2.52	0.36
PAH	HMW PAHs		0.73	1.16	0.87	0.32	1.92	0.94	0.37	0.47	0.14	0.16	0.03	0.28	0.32	0.18	0.20	1.42	0.12
PAH	Total PAHs		3.13	3.74	2.56	1.52	5.35	5.97	1.71	1.91	0.84	0.95	0.16	1.34	1.59	0.92	1.18	3.95	0.48
PCB	Total PCBs	6.43	4.40E-03	4.74E-03	0.05	1.70E-03	2.41E-03	4.47E-03	3.97E-03	3.73E-03	1.53E-03	1.10E-03	1.17E-03	1.80E-03	2.49E-03	1.08E-03	1.21E-03	2.39E-03	1.85E-03
PST	Aldrin	6.39	2.29E-06	2.77E-06	1.10E-06	1.02E-06	6.79E-07	1.08E-06	1.06E-06	1.14E-06	2.46E-06	1.28E-06	6.68E-06	1.15E-06	1.84E-06	1.33E-06	1.60E-06	2.77E-06	5.03E-06
PST	Hexachlorobenzene	5.79	7.29E-06	1.31E-05	5.36E-06	2.24E-06	4.22E-06	3.42E-06	3.38E-06	3.63E-06	7.81E-06	4.08E-06	2.13E-05	3.66E-06	5.87E-06	4.22E-06	5.09E-06	8.82E-06	1.60E-05
PST	Mirex	6.77	9.47E-07	2.15E-06	1.18E-05	7.12E-07	2.81E-07	2.24E-05	1.44E-06	3.34E-06	1.02E-06	1.56E-06	2.76E-06	1.75E-06	2.76E-06	1.89E-06	6.61E-07	2.61E-06	2.08E-06
PST	o,p'-DDE	6.65	1.27E-06	2.34E-05	3.97E-04	9.44E-06	1.87E-05	3.38E-05	2.14E-05	1.65E-06	8.63E-06	6.37E-06	9.58E-06	1.58E-06	1.02E-06	7.37E-07	6.33E-06	1.64E-05	1.11E-05
PST	p,p'-DDE	6.65	1.11E-05	9.35E-06	4.26E-06	1.15E-05	2.37E-05	2.65E-05	1.15E-05	1.51E-05	5.70E-06	6.82E-06	9.27E-07	1.66E-05	1.38E-05	9.53E-06	6.50E-06	1.75E-05	2.15E-06
TOC	% TOC		1.78	1.47	3.72	4.01	6.00	3.79	3.84	3.57	1.66	3.18	0.61	3.54	2.21	3.07	2.55	1.47	0.91

1 - Porewater concentration (µg/L) = sediment concentration/(foc X Koc)(foc=%TOC/100).

2 - See Table A-1 for Koc values.

3 - sum of Low Molecular Weight P 1-Methylnaphthalene, 1-Methylphenanthrene, 2,6-Dimethylnaphthalene, 2-Methylnaphthalene, Acenaphthene, Anthracene, Biphenyl, Fluorene, Naphthalene, and Phenanthrene.

4 - sum of High Molecular Weight P Benzo(a)anthracene, Benzo(a)pyrene, Benzo(e)pyrene, Chrysene, Dibenz(a,h)anthracene, Fluoranthene, Perylene, and Pyrene.

5 - Total PAHs - sum of LMW & HMW PAHs

6 - Sum of individual PCB congeners x 2; see Table A-3.1b.

Table A-3.1B. *Concentrations of PCB congeners and calculation of Total PCBs in surface sediment (0-15 cm) collected in the Derecktor Shipyard/Coddington Cove study area.*

PCB CONGENERS
ERA investigation.

Class	Analyte	Log$_{10}$Koc	DSY-25	DSY-26	DSY-27	DSY-28	DSY-29	DSY-30	DSY-31	DSY-32	DSY-33	DSY-34	DSY-35	DSY-36	DSY-37	DSY-38	DSY-39	DSY-40	DSY-41
PCB	PCB101	6.27	1.94E-04	2.08E-04	3.16E-03	7.34E-05	1.47E-04	2.68E-04	1.77E-04	2.14E-04	5.60E-05	4.83E-05	4.49E-05	1.01E-04	1.54E-04	4.87E-05	4.37E-05	1.42E-04	3.39E-05
PCB	PCB105	6.54	2.84E-05	3.59E-05	1.07E-03	1.48E-05	3.15E-05	5.39E-05	3.32E-05	2.14E-05	9.84E-06	7.24E-06	1.66E-06	1.12E-05	1.85E-05	5.44E-06	6.09E-06	3.04E-05	3.83E-06
PCB	PCB118	6.63	6.65E-05	9.96E-05	1.54E-03	4.18E-05	7.15E-05	1.22E-04	8.47E-05	7.48E-05	3.34E-05	2.61E-05	5.24E-06	4.08E-05	5.67E-05	1.91E-05	2.09E-05	7.76E-05	1.06E-05
PCB	PCB128	6.63	1.81E-05	2.15E-05	4.63E-04	1.11E-05	2.00E-05	3.90E-05	1.89E-05	2.08E-05	7.84E-06	6.49E-06	1.36E-06	1.24E-05	1.89E-05	6.41E-06	5.59E-06	2.27E-05	6.72E-06
PCB	PCB138	6.71	6.39E-05	9.45E-05	1.37E-03	5.23E-05	8.57E-05	1.35E-04	8.09E-05	8.20E-05	3.36E-05	2.95E-05	4.43E-06	4.94E-05	6.46E-05	3.22E-05	3.13E-05	9.27E-05	1.40E-05
PCB	PCB153	6.80	3.85E-05	6.58E-05	7.35E-04	3.92E-05	5.90E-05	8.53E-05	5.91E-05	5.40E-05	2.59E-05	2.38E-05	5.33E-06	3.55E-05	4.17E-05	2.28E-05	2.73E-05	6.25E-05	1.01E-05
PCB	PCB170	7.15	3.56E-06	7.43E-06	8.45E-05	5.56E-06	8.49E-06	1.18E-05	7.10E-06	4.60E-06	3.42E-06	3.12E-06	1.51E-06	3.52E-06	4.53E-06	3.11E-06	4.24E-06	8.24E-06	1.48E-06
PCB	PCB18	5.15	2.63E-04	3.76E-04	1.58E-03	7.92E-05	7.91E-05	2.42E-04	2.47E-04	1.79E-04	1.12E-04	5.22E-05	1.74E-05	9.79E-05	1.07E-04	1.56E-04	6.82E-05	1.62E-04	2.31E-04
PCB	PCB180	7.24	6.05E-06	1.08E-05	8.30E-05	8.37E-06	1.32E-05	1.78E-05	1.03E-05	7.37E-06	5.27E-06	4.51E-06	2.66E-06	5.24E-06	6.67E-06	4.76E-06	6.32E-06	1.36E-05	2.38E-06
PCB	PCB187	7.05	9.03E-06	1.17E-05	6.19E-05	8.78E-06	1.25E-05	1.66E-05	1.09E-05	1.07E-05	6.43E-06	5.30E-06	1.14E-06	8.57E-06	9.69E-06	5.55E-06	6.47E-06	1.37E-05	3.23E-06
PCB	PCB195	7.43	3.39E-07	1.27E-06	2.91E-06	8.90E-07	2.33E-06	9.82E-07	1.73E-06	5.53E-07	4.16E-07	5.74E-07	5.55E-07	3.38E-07	3.08E-07	3.25E-07	8.30E-07	1.40E-06	7.57E-07
PCB	PCB206	7.95	9.46E-07	1.61E-06	2.23E-06	8.66E-07	3.18E-06	1.84E-06	1.26E-06	8.38E-07	7.50E-07	6.34E-07	7.97E-07	7.01E-07	1.40E-06	4.05E-07	8.42E-07	1.80E-06	9.46E-07
PCB	PCB209	8.04	4.65E-07	1.26E-06	1.23E-06	9.05E-07	1.57E-05	1.63E-06	1.07E-06	1.10E-06	7.06E-07	5.66E-07	5.68E-07	6.14E-07	1.28E-06	4.60E-07	7.38E-07	1.75E-06	8.84E-07
PCB	PCB28	5.57	3.07E-04	2.28E-04	9.24E-04	9.95E-05	7.27E-05	1.79E-04	2.55E-04	1.95E-04	9.14E-05	7.33E-05	1.04E-04	9.56E-05	9.22E-05	4.88E-05	8.28E-05	1.20E-04	6.67E-05
PCB	PCB44	5.65	2.54E-04	2.98E-04	3.88E-03	8.14E-05	1.44E-04	2.63E-04	2.14E-04	1.61E-04	7.18E-05	5.93E-05	1.32E-04	7.00E-05	1.06E-04	3.41E-05	8.11E-05	1.21E-04	1.41E-04
PCB	PCB52	5.74	3.26E-04	4.46E-04	6.35E-03	1.29E-04	2.89E-04	4.41E-04	3.42E-04	2.25E-04	1.05E-04	7.82E-05	1.52E-04	7.00E-05	1.72E-04	4.17E-05	8.55E-05	1.81E-04	1.63E-04
PCB	PCB66	6.09	2.77E-04	8.87E-05	3.87E-03	3.31E-05	5.10E-05	1.99E-05	5.69E-04	2.54E-04	2.20E-05	2.23E-05	1.62E-05	1.21E-04	1.73E-04	5.45E-05	2.83E-05	3.87E-05	2.35E-05
PCB	PCB8	4.98	3.45E-04	3.76E-04	1.57E-03	1.72E-04	1.02E-04	3.34E-04	3.87E-04	3.58E-04	1.79E-04	1.07E-04	9.35E-05	1.74E-04	2.15E-04	5.71E-05	1.05E-04	1.03E-04	2.13E-04
PCB	SUMPCB	0	2.20E-03	2.37E-03	2.68E-02	8.52E-04	1.21E-03	2.23E-03	1.99E-03	1.87E-03	7.65E-04	5.48E-04	5.85E-04	8.99E-04	1.24E-03	5.42E-04	6.05E-04	1.20E-03	9.27E-04
PCB	TOTPCB	0	4.40E-03	4.74E-03	5.35E-02	1.70E-03	2.41E-03	4.47E-03	3.97E-03	3.73E-03	1.53E-03	1.10E-03	1.17E-03	1.80E-03	2.49E-03	1.08E-03	1.21E-03	2.39E-03	1.85E-03
TOC	% TOC		1.79	1.47	3.73	4.01	6.09	3.79	3.84	3.57	1.66	3.18	0.61	3.55	2.21	3.08	2.55	1.48	0.81

Units: =µg/L.
SUMPCB = Sum of congener concentrations
TOTPCB = Total PCBs - SUMPCB x 2
1 - Porewater concentration (µg/L) = sediment concentration/(foc X K$_{OC}$). The foc=%TOC/100; sediment PCB congener concentrations reported in Table A-2.1c.
2 - See Table A-1 for Koc values.

Table A-3.2. Hazard Quotients calculated for CoCs in sediment porewaters from the Derecktor
Shipyard/Coddington Cove study area[1].

Clas	Analyte	WQSV[2]	DSY-25	DSY-26	DSY-27	DSY-28	DSY-29	DSY-30	DSY-31	DSY-32	DSY-33	DSY-34	DSY-35	DSY-36	DSY-37	DSY-38	DSY-39	DSY-40	DSY-41
MET	Arsenic	36.00																	
MET	Cadmium	9.30																	
MET	Chromium	50.00																	
MET	Copper	2.90																	
MET	Lead	8.50																	
MET	Mercury	0.03																	
MET	Nickel	8.30																	
MET	Silver	0.92																	
MET	Zinc	86.00																	
MET	SEM:AVS	5.00	-4.34	-0.58	-32.87	-11.10	-35.12	-3.90	-9.45	-2.90	0.21	-5.62	-0.06	-7.10	0.08	-5.57	-3.85	-3.32	-0.64
PAH	1,6,7-Trimethylnaphthalene																		
PAH	1-Methylnaphthalene																		
PAH	1-Methylphenanthrene																		
PAH	2,6-Dimethylnaphthalene																		
PAH	2-Methylnaphthalene	0.88	0.09	0.13	0.13	0.16	0.17	0.33	0.14	0.13	0.08	0.11	0.02	0.09	0.11	0.06	0.08	0.16	0.04
PAH	Acenaphthene	710	4.63E-04	1.64E-04	1.27E-04	8.50E-05	6.20E-04	1.03E-03	8.81E-05	7.90E-05	3.94E-05	5.31E-05	7.38E-06	6.13E-05	6.62E-05	4.20E-05	7.86E-05	2.17E-04	4.17E-05
PAH	Acenaphthylene	0.46	0.97	1.45	0.87	0.42	1.14	0.55	0.42	0.84	0.16	0.21	0.02	0.48	0.35	0.19	0.20	1.48	0.02
PAH	Anthracene	0.29	1.99	2.14	1.21	0.54	2.38	1.41	0.61	0.98	0.22	0.24	0.03	0.62	0.75	0.36	0.35	1.87	0.16
PAH	Benzo(a)anthracene	0.07	0.71	1.35	0.83	0.28	1.72	0.70	0.28	0.42	0.12	0.12	0.02	0.24	0.25	0.14	0.15	0.61	0.07
PAH	Benzo(a)pyrene	0.04	0.52	0.69	0.58	0.22	0.92	0.50	0.25	0.32	0.10	0.11	0.02	0.21	0.17	0.09	0.13	0.50	0.05
PAH	Benzo(b)fluoranthene																		
PAH	Benzo(e)pyrene																		
PAH	Benzo(g,h,i)perylene																		
PAH	Benzo(k)fluoranthene																		
PAH	Biphenyl																		
PAH	Chrysene	0.10	0.71	1.05	0.64	0.24	1.22	0.49	0.27	0.36	0.09	0.10	0.02	0.21	0.18	0.09	0.12	0.79	0.07
PAH	Dibenz(a,h)anthracene	1.68E-03	0.54	0.66	0.56	0.26	0.83	0.54	0.26	0.32	0.12	0.13	0.02	0.22	0.21	0.11	0.17	0.57	0.06
PAH	Fluoranthene	16.00	0.02	0.03	0.01	6.62E-03	0.05	0.02	6.02E-03	8.88E-03	3.32E-03	3.78E-03	6.85E-04	5.64E-03	6.87E-03	4.34E-03	4.90E-03	0.03	2.70E-03
PAH	Fluorene	0.14	1.30	1.93	0.87	0.41	2.58	2.45	0.39	0.38	0.21	0.23	0.05	0.27	0.23	0.11	0.30	0.68	0.14
PAH	Indeno(1,2,3-cd)pyrene																		
PAH	Naphthalene	620	8.11E-04	8.82E-04	9.01E-04	7.51E-04	1.02E-03	2.88E-03	9.47E-04	9.59E-04	5.25E-04	5.62E-04	8.67E-05	7.72E-04	9.76E-04	6.07E-04	7.45E-04	1.15E-03	1.82E-04
PAH	Perylene																		
PAH	Phenanthrene	0.81	0.66	0.90	0.38	0.23	1.12	1.40	0.23	0.21	0.12	0.14	0.03	0.16	0.16	0.09	0.19	0.86	0.10
PAH	Pyrene	0.63	0.49	0.76	0.79	0.24	1.33	0.69	0.33	0.39	0.10	0.12	0.02	0.20	0.25	0.12	0.13	1.22	0.09
PAH	LMW PAHs		4.05	5.10	2.58	1.34	6.25	5.60	1.37	1.70	0.63	0.72	0.12	1.05	1.25	0.63	0.93	3.57	0.44
PAH	HMW PAHs		2.98	4.53	3.41	1.25	6.07	2.95	1.40	1.81	0.52	0.59	0.09	1.09	1.06	0.56	0.71	3.71	0.34
PAH	Total PAHs		7.03	9.63	5.99	2.58	12.33	8.55	2.77	3.51	1.15	1.31	0.21	2.13	2.31	1.18	1.64	7.28	0.78
PCB	Total PCBs	0.03	0.15	0.16	1.78	0.06	0.08	0.15	0.13	0.12	0.05	0.04	0.04	0.06	0.08	0.04	0.04	0.08	0.06
PST	Aldrin	0.16	1.40E-05	1.70E-05	6.72E-06	6.24E-06	4.17E-06	6.60E-06	6.51E-06	7.00E-06	1.51E-05	7.86E-06	4.10E-05	7.06E-06	1.13E-05	8.15E-06	9.81E-06	1.70E-05	3.09E-05
PST	Hexachlorobenzene	3.68	1.98E-06	3.55E-06	1.46E-06	6.09E-07	1.15E-06	9.30E-07	9.18E-07	9.87E-07	2.12E-06	1.11E-06	5.78E-06	9.96E-07	1.59E-06	1.15E-06	1.38E-06	2.40E-06	4.35E-06
PST	Mirex	1.00E-03	9.47E-04	2.15E-03	0.01	7.12E-04	2.81E-04	0.02	1.44E-03	3.34E-03	1.02E-03	1.56E-03	2.76E-03	1.75E-03	2.76E-03	1.89E-03	6.61E-04	2.61E-03	2.08E-03
PST	o,p'-DDE	1.00E-03	1.27E-03	0.02	0.40	9.44E-03	0.02	0.03	0.02	1.65E-03	8.63E-03	6.37E-03	9.58E-03	1.58E-03	1.02E-03	7.37E-04	6.33E-03	0.02	0.01
PST	p,p'-DDE	1.00E-03	0.01	9.35E-03	0.04	0.01	0.02	0.03	0.01	0.02	5.70E-03	6.82E-03	9.27E-04	0.02	0.01	9.53E-03	6.50E-03	0.02	2.15E-03

1 - Hazard Quotients calculated as EqP-calculated porewater concentration (Table A-3.1A)/WQSV.
2 - Water Quality Screening Value (Table 4).

Table A-3.3A. Porewater Hazard Quotients[1] (PW-HQs) for Derecktor Shipyard Marine ERA stations exhibiting **NO TOXICITY**[2] to amphipods (*Ampelisca abdita*).

Class	Analyte	DSY-25	DSY-26			DSY-29	DSY-30	DSY-31	DSY-32	DSY-33	DSY-34	DSY-35	DSY-36	DSY-37	DSY-38	DSY-39	DSY-40	DSY-41	n	Mean	95% UCL[3]
MET	Arsenic																		0		
MET	Cadmium																		0		
MET	Chromium																		0		
MET	Copper																		0		
MET	Lead																		0		
MET	Mercury																		0		
MET	Nickel																		0		
MET	Silver																		0		
MET	Zinc																		0		
MET	SEM:AVS	-4.34	-0.58			-35.12	-3.90	-9.45	-2.90	0.21	-5.62	-0.06	-7.10	0.08	-5.57	-3.85	-3.32	-0.64	15	-5.48	-0.67
PAH	1,6,7-Trimethylnaphthalene																		0		
PAH	1-Methylnaphthalene																		0		
PAH	1-Methylphenanthrene																		0		
PAH	2,6-Dimethylnaphthalene																		0		
PAH	2-Methylnaphthalene	0.09	0.13			0.17	0.33	0.14	0.13	0.08	0.11	0.02	0.09	0.11	0.06	0.08	0.16	0.04	15.00	0.12	0.16
PAH	Acenaphthene	4.63E-04	1.64E-04			6.20E-04	1.03E-03	8.81E-05	7.90E-05	3.94E-05	5.31E-05	7.38E-06	6.13E-05	6.62E-05	4.20E-05	7.86E-05	2.17E-04	4.17E-05	15.00	2.03E-04	3.60E-04
PAH	Acenaphthylene	0.97	1.45			1.14	0.55	0.42	0.84	0.16	0.21	0.02	0.48	0.35	0.19	0.20	1.48	0.02	15.00	0.56	0.84
PAH	Anthracene	1.99	2.14			2.38	1.41	0.61	0.98	0.22	0.24	0.03	0.52	0.75	0.36	0.35	1.87	0.16	15.00	0.93	1.38
PAH	Benzo(a)anthracene	0.71	1.35			1.72	0.70	0.28	0.42	0.12	0.12	0.02	0.24	0.25	0.14	0.15	0.61	0.07	15.00	0.46	0.73
PAH	Benzo(a)pyrene	0.52	0.69			0.92	0.50	0.25	0.32	0.10	0.11	0.02	0.21	0.17	0.09	0.13	0.50	0.05	15.00	0.31	0.45
PAH	Benzo(b)fluoranthene																		0		
PAH	Benzo(e)pyrene																		0		
PAH	Benzo(g,h,i)perylene																		0		
PAH	Benzo(k)fluoranthene																		0		
PAH	Biphenyl																		0		
PAH	Chrysene	0.71	1.05			1.22	0.49	0.27	0.36	0.09	0.10	0.02	0.21	0.18	0.09	0.12	0.79	0.07	15.00	0.38	0.59
PAH	Dibenz(a,h)anthracene	0.54	0.66			0.83	0.54	0.26	0.32	0.12	0.13	0.02	0.22	0.21	0.11	0.17	0.57	0.06	15.00	0.32	0.45
PAH	Fluoranthene	0.02	0.03			0.05	0.02	6.02E-03	8.68E-03	3.32E-03	3.78E-03	6.85E-04	5.64E-03	6.87E-03	4.34E-03	4.90E-03	0.03	2.70E-03	15.00	0.01	0.02
PAH	Fluorene	1.30	1.93			2.58	2.45	0.39	0.38	0.21	0.23	0.05	0.27	0.23	0.11	0.30	0.68	0.14	15.00	0.75	1.23
PAH	Indeno(1,2,3-cd)pyrene																		0		
PAH	Naphthalene	8.11E-04	8.82E-04			1.02E-03	2.88E-03	9.47E-04	9.59E-04	5.25E-04	5.62E-04	8.67E-05	7.72E-04	9.76E-04	6.07E-04	7.45E-04	1.15E-03	1.82E-03	15.00	8.73E-04	1.22E-03
PAH	Perylene																		0		
PAH	Phenanthrene	0.66	0.90			1.12	1.40	0.23	0.21	0.12	0.14	0.03	0.16	0.16	0.09	0.19	0.86	0.10	15.00	0.42	0.67
PAH	Pyrene	0.49	0.76			1.33	0.69	0.33	0.39	0.10	0.12	0.02	0.20	0.25	0.12	0.13	1.22	0.09	15.00	0.42	0.64
PAH	LMW PAHs	4.05	5.10			6.25	5.60	1.37	1.70	0.63	0.72	0.12	1.05	1.25	0.63	0.93	3.57	0.44	15.00	2.23	3.38
PAH	HMW PAHs	2.98	4.53			6.07	2.95	1.40	1.81	0.52	0.59	0.09	1.09	1.06	0.56	0.71	3.71	0.34	15.00	1.89	2.87
PAH	Total PAHs	7.03	9.63			12.33	8.55	2.77	3.51	1.15	1.31	0.21	2.13	2.31	1.18	1.64	7.28	0.78	15.00	4.12	6.22
PCB	Total PCBs	0.15	0.16			0.08	0.15	0.13	0.12	0.05	0.04	0.04	0.06	0.08	0.04	0.04	0.08	0.06	15.00	0.09	0.11
PST	Aldrin	1.40E-05	1.70E-05			4.17E-06	6.60E-06	6.51E-06	7.00E-06	1.51E-05	7.86E-06	4.10E-05	7.06E-06	1.13E-05	8.15E-06	9.81E-06	1.70E-05	3.09E-05	15.00	1.36E-05	1.91E-05
PST	Hexachlorobenzene	1.98E-06	3.55E-06			1.15E-06	9.30E-07	9.18E-07	9.87E-07	2.12E-06	1.11E-06	5.78E-06	9.96E-07	1.59E-06	1.15E-06	1.38E-06	2.40E-06	4.35E-06	15.00	2.03E-06	2.83E-06
PST	Mirex	9.47E-04	2.15E-03			2.81E-04	0.02	1.44E-03	3.34E-03	1.02E-03	1.56E-03	2.76E-03	1.75E-03	2.76E-03	1.89E-03	6.61E-04	2.61E-03	2.08E-03	15.00	3.18E-03	6.14E-03
PST	o,p'-DDE	1.27E-03	0.02			0.02	0.03	0.02	1.65E-03	8.63E-03	6.37E-03	9.58E-03	1.58E-03	1.02E-03	7.37E-04	6.33E-03	0.02	0.01	15.00	0.01	0.02
PST	p,p'-DDE	0.01	9.35E-03			0.02	0.03	0.01	0.02	5.70E-03	6.82E-03	9.27E-04	0.02	0.01	9.53E-03	6.50E-03	0.02	2.15E-03	15.00	0.01	0.02

1 - Hazard Quotients from Table A-3.2.
2 - Toxicity data contained in Derecktor Shipyard Marine ERA (SAIC and URI, 1997), Table 5-2-1.
3 - 95% Upper Confidence Limit based on sample size as follows: Mean+(t$_{0.975}$(df)*(STDEV/SQRT(n))); where STDEV=standard deviation;
n=sample size;t$_{0.975}$(df)=sample size-dependent percentage points of the t distribution (Ott, 1993).

Table A-3.3B. Porewater Hazard Quotients[1] (PW-HQs) for the Derecktor Shipyard Marine ERA stations exhibiting **TOXICITY**[2] to amphipods (*Ampelisca abdita*).

Class	Analyte	DSY-27	DSY-28	N	Mean	Maximum HQ
MET	Arsenic			0		
MET	Cadmium			0		
MET	Chromium			0		
MET	Copper			0		
MET	Lead			0		
MET	Mercury			0		
MET	Nickel			0		
MET	Silver			0		
MET	Zinc			0		
MET	SEM:AVS	-32.87	-11.10	2.00	-21.98	-11.10
PAH	1,6,7-Trimethylnaphthalene			0		
PAH	1-Methylnaphthalene			0		
PAH	1-Methylphenanthrene			0		
PAH	2,6-Dimethylnaphthalene			0		
PAH	2-Methylnaphthalene	0.13	0.16	2.00	0.14	0.16
PAH	Acenaphthene	1.27E-04	8.50E-05	2.00	1.06E-04	1.27E-04
PAH	Acenaphthylene	0.87	0.42	2.00	0.65	0.87
PAH	Anthracene	1.21	0.54	2.00	0.87	1.21
PAH	Benzo(a)anthracene	0.83	0.28	2.00	0.56	0.83
PAH	Benzo(a)pyrene	0.58	0.22	2.00	0.40	0.58
PAH	Benzo(b)fluoranthene			0		
PAH	Benzo(e)pyrene			0		
PAH	Benzo(g,h,i)perylene			0		
PAH	Benzo(k)fluoranthene			0		
PAH	Biphenyl			0		
PAH	Chrysene	0.64	0.24	2.00	0.44	0.64
PAH	Dibenz(a,h)anthracene	0.56	0.26	2.00	0.41	0.56
PAH	Fluoranthene	0.01	6.62E-03	2.00	9.55E-03	0.01
PAH	Fluorene	0.87	0.41	2.00	0.64	0.87
PAH	Indeno(1,2,3-cd)pyrene			0		
PAH	Naphthalene	9.01E-04	7.51E-04	2.00	8.26E-04	9.01E-04
PAH	Perylene			0		
PAH	Phenanthrene	0.38	0.23	2.00	0.30	0.38
PAH	Pyrene	0.79	0.24	2.00	0.52	0.79
PAH	LMW PAHs	2.58	1.34	2.00	1.96	2.58
PAH	HMW PAHs	3.41	1.25	2.00	2.33	3.41
PAH	Total PAHs	5.99	2.58	2.00	4.28	5.99
PCB	Total PCBs	1.78	0.06	2.00	0.92	1.78
PST	Aldrin	6.72E-06	6.24E-06	2.00	6.48E-06	6.72E-06
PST	Hexachlorobenzene	1.46E-06	6.09E-07	2.00	1.03E-06	1.46E-06
PST	Mirex	0.01	7.12E-04	2.00	6.23E-03	0.01
PST	o,p'-DDE	0.40	9.44E-03	2.00	0.20	0.40
PST	p,p'-DDE	0.04	0.01	2.00	0.03	0.04

1 - Hazard Quotients from Table A-3.2.

2 - Toxicity data contained in Derecktor Shipyard Marine ERA (SAIC and URI 1997), Table 5.2-1.

Table A-4.1. Elutriate concentrations for sediments collected from the Derecktor Shipyard study area[1].

Class	Analyte[2]	DSY-25	DSY-26	DSY-27	DSY-28	DSY-29	DSY-30	DSY-31	DSY-32	DSY-33	DSY-34	DSY-35	DSY-36	DSY-37	DSY-38	DSY-39	DSY-40	DSY-41
MET	Arsenic	12.40						27.20	24.80	2.50			40.40	19.60	40.70	76.00	30.00	
MET	Cadmium	0.10						0.10	0.10	0.10			0.10	0.10	0.10	0.10	0.10	
MET	Chromium	0.40						0.40	0.40	0.40			0.40	0.40	0.40	0.40	0.40	
MET	Copper	1.25						5.10	1.25	1.25			1.25	1.25	1.25	1.25	1.25	
MET	Lead	9.40						8.50	9.40	15.90			8.30	12.90	10.70	14.60	9.00	
MET	Mercury	0.10						0.10	0.10	0.10			0.10	0.10	0.10	0.10	0.10	
MET	Nickel	4.00						4.00	4.00	4.00			4.00	4.00	4.00	4.00	4.00	
MET	Silver	0.25						0.25	0.25	0.25			0.25	0.25	0.25	0.25	0.25	
MET	Zinc	4.50						4.50	4.50	4.50			4.50	4.50	4.50	4.50	4.50	
MET	SEM:AVS	2.88	1.18	12.10	7.47	7.57	5.51	2.79	2.70	1.86	1.43	1.02	1.44	2.77	1.91	2.43	2.16	1.31
PAH	1,6,7-Trimethylnaphthalene																	
PAH	1-Methylnaphthalene																	
PAH	1-Methylphenanthrene																	
PAH	2,6-Dimethylnaphthalene																	
PAH	2-Methylnaphthalene	11.35						4.56	4.81	9.76			5.75	6.21	6.07	5.08	4.27	
PAH	Acenaphthene	27.69		1.95		3.95		2.22	2.65	2.22			1.97	1.70	2.07	2.13	2.45	
PAH	Acenaphthylene	12.85		1.70		1.70		2.89	3.92	6.82			2.99	1.60	1.11	2.18	4.84	
PAH	Anthracene	46.78				8.06		6.33	9.60	8.68			5.91	4.44	2.97	4.43	14.08	
PAH	Benzo(a)anthracene	46.47				42.13		8.77	7.50	11.94			6.56	4.53	3.78	4.82	12.15	
PAH	Benzo(a)pyrene	40.92		6.56		16.10		11.01	11.25	17.42			7.76	3.73	1.77	7.74	11.69	
PAH	Benzo(b)fluoranthene																	
PAH	Benzo(e)pyrene																	
PAH	Benzo(g,h,i)perylene																	
PAH	Benzo(k)fluoranthene																	
PAH	Biphenyl																	
PAH	Chrysene	31.67						3.85	4.17	12.12			4.55	3.25	2.38	3.98	5.80	
PAH	Dibenz(a,h)anthracene	8.25		11.50		11.50		1.99	4.51	3.80			0.59	1.40	11.50	11.50	1.61	
PAH	Fluoranthene	78.24		17.03		118		11.30	12.47	25.27			13.31	12.53	11.00	12.02	19.00	
PAH	Fluorene	24.80		6.15		6.15		1.62	2.18	4.75			1.99	1.84	2.40	1.96	1.82	
PAH	Indeno(1,2,3-cd)pyrene																	
PAH	Naphthalene	14.60						5.24	11.64	12.82			9.58	8.22	10.91	6.65	7.66	
PAH	Perylene																	
PAH	Phenanthrene	28.71		8.73		10.07		10.75	8.92	14.97			8.99	12.67	8.37	9.06	11.28	
PAH	Pyrene	227		203		311		87.72	79.89	31.70			33.60	27.37	14.17	14.49	274	
PAH	LMW PAHs	154		16.84		28.23		30.72	39.81	53.21			34.19	35.09	32.80	29.31	41.56	
PAH	HMW PAHs	433		238		499		125	120	102			66.37	52.82	44.60	54.55	325	
PAH	Total PAHs	586		255		527		155	160	155			101	87.90	77.39	83.85	366	
PCB	Total PCBs	77.82		69.45		54.32		58.83	39.09	26.62			26.26	37.43	19.20	25.87	36.66	
PST	Aldrin	1.60		0.88		0.94		1.60	1.60	1.60			1.60	1.60	1.60	1.60	1.60	
PST	Hexachlorobenzene	0.08		0.11		0.90		0.26	0.06	0.08			0.90	0.05	0.05	0.05	0.11	
PST	Mirex	0.40		0.09		0.71		0.60	0.13	0.60			0.60	0.09	0.10	0.05	0.10	
PST	o,p'-DDE	3.52		2.80		2.97		3.21	1.90	1.33			2.04	3.39	1.44	2.25	2.48	
PST	p,p'-DDE	0.42		0.42		0.63		0.64	0.30	0.31			0.39	0.71	0.25	0.61	0.59	

Units: metals - μg/L; organics- ng/L

1 - Elutriate concentration as reported in Derecktor Shipyard ERA, Appendix A-1-2 (SAIC, 1997).

2 - SEM concentration used; AVS assumed = 0 in resuspended sediment.

Table A-4.2. Elutriate Hazard Quotients (ELU-HQs) for sediments collected from the Derecktor Shipyard study area[1].

Class	Analyte	WQSV[2]	DSY-25	DSY-26	DSY-27	DSY-28	DSY-29	DSY-30	DSY-31	DSY-32	DSY-33	DSY-34	DSY-35	DSY-36	DSY-37	DSY-38	DSY-39	DSY-40	DSY-41
MET	Arsenic	36.00	0.34						0.76	0.69	0.07			1.12	0.54	1.13	2.11	0.83	
MET	Cadmium	9.30	0.01						0.01	0.01	0.01			0.01	0.01	0.01	0.01	0.01	
MET	Chromium	50.00	8.00E-03						8.00E-03	8.00E-03	8.00E-03			8.00E-03	8.00E-03	8.00E-03	8.00E-03	8.00E-03	
MET	Copper	2.90	0.43						1.76	0.43	0.43			0.43	0.43	0.43	0.43	0.43	
MET	Lead	8.50	1.11						1.00	1.11	1.87			0.98	1.52	1.26	1.72	1.06	
MET	Mercury	0.03	4.00						4.00	4.00	4.00			4.00	4.00	4.00	4.00	4.00	
MET	Nickel	8.30	0.48						0.48	0.48	0.48			0.48	0.48	0.48	0.48	0.48	
MET	Silver	0.92	0.27						0.27	0.27	0.27			0.27	0.27	0.27	0.27	0.27	
MET	Zinc	86.00	0.05						0.05	0.05	0.05			0.05	0.05	0.05	0.05	0.05	
MET	SEM:AVS	5.00	0.58	0.24	2.42	1.49	1.51	1.10	0.56	0.54	0.37	0.29	0.20	0.29	0.55	0.38	0.49	0.43	0.26
PAH	1,6,7-Trimethylnaphthalene																		
PAH	1-Methylnaphthalene																		
PAH	1-Methylphenanthrene																		
PAH	2,6-Dimethylnaphthalene																		
PAH	2-Methylnaphthalene	0.88	0.01						5.21E-03	5.49E-03	0.01	•		6.57E-03	7.10E-03	6.94E-03	5.80E-03	4.88E-03	
PAH	Acenaphthene	710	3.90E-05		2.75E-06		5.56E-06		3.13E-06	3.74E-06	3.13E-06			2.77E-06	2.39E-06	2.91E-06	3.01E-06	3.45E-06	
PAH	Acenaphthylene	0.46	0.03		3.70E-03		3.70E-03		6.30E-03	8.54E-03	0.01			6.52E-03	3.49E-03	2.41E-03	4.75E-03	0.01	
PAH	Anthracene	0.29	0.16				0.03		0.02	0.03	0.03			0.02	0.02	0.01	0.02	0.05	
PAH	Benzo(a)anthracene	0.07	0.71				0.65		0.13	0.12	0.18			0.10	0.07	0.06	0.07	0.19	
PAH	Benzo(a)pyrene	0.04	0.97		0.15		0.38		0.26	0.27	0.41			0.18	0.09	0.04	0.18	0.28	
PAH	Benzo(b)fluoranthene																		
PAH	Benzo(e)pyrene																		
PAH	Benzo(g,h,i)perylene																		
PAH	Benzo(k)fluoranthene																		
PAH	Biphenyl																		
PAH	Chrysene	0.10	0.33						0.04	0.04	0.13			0.05	0.03	0.02	0.04	0.06	
PAH	Dibenz(a,h)anthracene	1.68E-03	4.91		6.84		6.84		1.18	2.68	2.26			0.35	0.83	6.84	6.84	0.96	
PAH	Fluoranthene	16.00	4.89E-03		1.06E-03		7.36E-03		7.07E-04	7.79E-04	1.58E-03			8.32E-04	7.83E-04	6.87E-04	7.51E-04	1.19E-03	
PAH	Fluorene	0.14	0.18		0.04		0.04		0.01	0.02	0.03			0.01	0.01	0.02	0.01	0.01	
PAH	Indeno(1,2,3-cd)pyrene																		
PAH	Naphthalene	620	2.38E-05						8.45E-06	1.88E-05	2.07E-05			1.55E-05	1.33E-05	1.76E-05	1.07E-05	1.24E-05	
PAH	Perylene																		
PAH	Phenanthrene	0.81	0.04		0.01		0.01		0.01	0.01	0.02			0.01	0.02	0.01	0.01	0.01	
PAH	Pyrene	0.63	0.36		0.32		0.49		0.14	0.13	0.05			0.05	0.04	0.02	0.02	0.44	
PAH	LMW PAHs		0.39		0.06		0.09		0.05	0.07	0.09			0.05	0.05	0.05	0.05	0.08	
PAH	HMW PAHs		7.29		7.32		8.37		1.76	3.23	3.03			0.74	1.07	6.99	7.16	1.92	
PAH	Total PAHs		7.68		7.37		8.46		1.81	3.30	3.13			0.79	1.12	7.03	7.21	2.00	
PCB	Total PCBs	0.03	2.59		2.31		1.81		1.96	1.30	0.89			0.88	1.25	0.64	0.86	1.22	
PST	Aldrin	0.16	9.82E-03		5.37E-03		5.79E-03		9.82E-03	9.82E-03	9.82E-03			9.82E-03	9.82E-03	9.82E-03	9.82E-03	9.82E-03	
PST	Hexachlorobenzene	3.68	2.14E-05		3.01E-05		2.45E-04		7.19E-05	1.58E-05	2.27E-05			2.45E-04	1.36E-05	1.38E-05	1.45E-05	3.03E-05	
PST	Mirex	1.00E-03	0.40		0.09		0.71		0.60	0.13	0.60			0.60	0.09	0.10	0.05	0.10	
PST	o,p'-DDE	1.00E-03	3.52		2.80		2.97		3.21	1.90	1.33			2.04	3.39	1.44	2.25	2.48	
PST	p,p'-DDE	1.00E-03	0.42		0.42		0.63		0.64	0.30	0.31			0.39	0.71	0.25	0.61	0.59	

1 - ELU-HQ calculated as elutriate concentration (Table A-4.1)/WQSV.
2 - Water Quality Screening Value (Table 4).

Table A-4.3A. Elutriate Hazard Quotients[1] (ELU-HQs) for Derecktor Shipyard Marine ERA stations exhibiting **NO TOXICITY**[2] to sea urchin (*Arbacia punctulata*) FERTILIZATION.

Class	Analyte[3]	DSY-25	DSY-26	DSY-27	DSY-28	DSY-29	DSY-30	DSY-31	DSY-32	DSY-33	DSY-34	DSY-35	DSY-36	DSY-37	DSY-38	DSY-39	DSY-40	DSY-41	c	Mean	95% UCL[3]
MET	Arsenic	0.34						0.76	0.69	0.07			1.12	0.54	1.13	2.11	0.83		9.00	0.84	0.84
MET	Cadmium	0.01						0.01	0.01	0.01			0.01	0.01	0.01	0.01	0.01		9.00	0.01	0.01
MET	Chromium	8.00E-03						8.00E-03	8.00E-03	8.00E-03			8.00E-03	8.00E-03	8.00E-03	8.00E-03	8.00E-03		9.00	8.00E-03	8.00E-03
MET	Copper	0.43						1.76	0.43	0.43			0.43	0.43	0.43	0.43	0.43		9.00	0.58	0.58
MET	Lead	1.11						1.00	1.11	1.87			0.98	1.52	1.26	1.72	1.06		9.00	1.29	1.29
MET	Mercury	4.00						4.00	4.00	4.00			4.00	4.00	4.00	4.00	4.00		9.00	4.00	4.00
MET	Nickel	0.48						0.48	0.48	0.48			0.48	0.48	0.48	0.48	0.48		9.00	0.48	0.48
MET	Silver	0.27						0.27	0.27	0.27			0.27	0.27	0.27	0.27	0.27		9.00	0.27	0.27
MET	Zinc	0.05						0.05	0.05	0.05			0.05	0.05	0.05	0.05	0.05		9.00	0.05	0.05
MET	SEM:AVS	0.58	0.24	2.42	1.49	1.51	1.10	0.56	0.54	0.37	0.29	0.20	0.29	0.55	0.38	0.49	0.43	0.26	17.00	0.69	1.06
PAH	1,6,7-Trimethylnaphthalene																		0		
PAH	1-Methylnaphthalene																		0		
PAH	1-Methylphenanthrene																		0		
PAH	2,6-Dimethylnaphthalene																		0		
PAH	2-Methylnaphthalene	0.01						5.21E-03	5.49E-03	0.01			6.57E-03	7.10E-03	6.94E-03	5.80E-03	4.88E-03		9.00	7.34E-03	7.34E-03
PAH	Acenaphthene	3.90E-05		2.75E-06		5.56E-06		3.13E-06	3.74E-06	3.13E-06			2.77E-06	2.39E-06	2.91E-06	3.01E-06	3.45E-06		11.00	6.53E-06	6.53E-06
PAH	Acenaphthylene	0.03		3.70E-03		3.70E-03		6.30E-03	8.54E-03	0.01			6.52E-03	3.49E-03	2.41E-03	4.75E-03	0.01		11.00	8.44E-03	8.44E-03
PAH	Anthracene	0.16				0.03		0.02	0.03	0.03			0.02	0.02	0.01	0.02	0.05		10.00	0.04	0.04
PAH	Benzo(a)anthracene	0.71				0.65		0.13	0.12	0.18			0.10	0.07	0.06	0.07	0.19		10.00	0.23	0.23
PAH	Benzo(a)pyrene	0.97		0.15		0.38		0.26	0.27	0.41			0.18	0.09	0.04	0.18	0.28		11.00	0.29	0.29
PAH	Benzo(b)fluoranthene																		0		
PAH	Benzo(e)pyrene																		0		
PAH	Benzo(g,h,i)perylene																		0		
PAH	Benzo(k)fluoranthene																		0		
PAH	Biphenyl																		0		
PAH	Chrysene	0.33						0.04	0.04	0.13			0.05	0.03	0.02	0.04	0.06		9.00	0.08	0.08
PAH	Dibenz(a,h)anthracene	4.91		6.84		6.84		1.18	2.68	2.26			0.35	0.83	6.84	6.84	0.96		11.00	3.69	3.69
PAH	Fluoranthene	4.89E-03		1.06E-03		7.36E-03		7.07E-04	7.79E-04	1.58E-03			8.32E-04	7.83E-04	6.87E-04	7.51E-04	1.19E-03		11.00	1.87E-03	1.87E-03
PAH	Fluorene	-0.18		0.04		0.04		0.01	0.02	0.03			0.01	0.01	0.02	0.01	0.01		11.00	0.04	0.04
PAH	Indeno(1,2,3-cd)pyrene																		0		
PAH	Naphthalene	2.36E-05						8.45E-06	1.88E-05	2.07E-05			1.55E-05	1.33E-05	1.76E-05	1.07E-05	1.24E-05		9.00	1.57E-05	1.57E-05
PAH	Perylene																		0		
PAH	Phenanthrene	0.04		0.01		0.01		0.01	0.01	0.02			0.01	0.02	0.01	0.01	0.01		11.00	0.01	0.01
PAH	Pyrene	0.36		0.32		0.49		0.14	0.13	0.05			0.05	0.04	0.02	0.02	0.44		11.00	0.19	0.19
PAH	LMW PAHs	0.39		0.06		0.09		0.05	0.07	0.09			0.05	0.05	0.05	0.05	0.08		11.00	0.09	0.09
PAH	HMW PAHs	7.29		7.32		8.37		1.76	3.23	3.03			0.74	1.07	6.99	7.16	1.92		11.00	4.44	4.44
PAH	Total PAHs	7.68		7.37		8.46		1.81	3.30	3.13			0.79	1.12	7.03	7.21	2.00		11.00	4.54	4.54
PCB	Total PCBs	2.59		2.31		1.81		1.96	1.30	0.89			0.88	1.25	0.64	0.86	1.22		11.00	1.43	1.43
PST	Aldrin	9.82E-03		5.37E-03		5.79E-03		9.82E-03	9.82E-03	9.82E-03			9.82E-03	9.82E-03	9.82E-03	9.82E-03	9.82E-03		11.00	9.05E-03	9.05E-03
PST	Hexachlorobenzene	2.14E-05		3.01E-05		2.45E-04		7.19E-05	1.58E-05	2.27E-05			2.45E-04	1.36E-05	1.38E-05	1.45E-05	3.03E-05		11.00	6.58E-05	6.58E-05
PST	Mirex	0.40		0.09		0.71		0.60	0.13	0.60			0.60	0.09	0.10	0.05	0.10		11.00	0.32	0.32
PST	o,p'-DDE	3.52		2.80		2.97		3.21	1.90	1.33			2.04	3.39	1.44	2.25	2.48		11.00	2.48	2.48
PST	p,p'-DDE	0.42		0.42		0.63		0.64	0.30	0.31			0.39	0.71	0.25	0.61	0.59		11.00	0.48	0.48

1 - ELU-HQ from Table A-4.2

2 - Toxicity data contained in Derecktor Shipyard Marine ERA (SAIC and URI, 1997), Table 5.2-1.

3 - 95% Upper Confidence Limit based on sample size as follows: Mean+($t_{0.975}$(df)*(STDEV/SQRT(n))); where STDEV=standard deviation;

n=sample size; $t_{0.975}$(df)=sample size-dependent percentage points of the t distribution (Ott, 1993).

Table A-4.3B. Elutriate Hazard Quotients[1] (ELU-HQs) based on data from the Derecktor Shipyard Marine ERA for stations exhibiting **TOXICITY**[2] to sea urchin (*Arbacia punctulata*) FERTILIZATION.

Class	Analyte			n	Mean	Maximum HQ
MET	Arsenic			0		
MET	Cadmium			0		
MET	Chromium			0		
MET	Copper			0		
MET	Lead			0		
MET	Mercury			0		
MET	Nickel			0		
MET	Silver			0		
MET	Zinc			0		
PAH	1,6,7-Trimethylnaphthalene			0		
PAH	1-Methylnaphthalene			0		
PAH	1-Methylphenanthrene			0		
PAH	2,6-Dimethylnaphthalene			0		
PAH	2-Methylnaphthalene			0		
PAH	Acenaphthene			0		
PAH	Acenaphthylene			0		
PAH	Anthracene			0		
PAH	Benzo(a)anthracene			0		
PAH	Benzo(a)pyrene			0		
PAH	Benzo(b)fluoranthene			0		
PAH	Benzo(e)pyrene			0		
PAH	Benzo(g,h,i)perylene			0		
PAH	Benzo(k)fluoranthene			0		
PAH	Biphenyl			0		
PAH	Chrysene			0		
PAH	Dibenz(a,h)anthracene			0		
PAH	Fluoranthene			0		
PAH	Fluorene			0		
PAH	Indeno(1,2,3-cd)pyrene			0		
PAH	Naphthalene			0		
PAH	Perylene			0		
PAH	Phenanthrene			0		
PAH	Pyrene			0		
PAH	LMW PAHs			0		
PAH	HMW PAHs			0		
PAH	Total PAHs			0		
PCB	Total PCBs			0		
PST	Aldrin			0		
PST	Hexachlorobenzene			0		
PST	Mirex			0		
PST	o,p'-DDE			0		
PST	p,p'-DDE			0		

1 - ELU-HQ from Table A-4.2.

2 - Toxicity data contained in Derecktor Shipyard Marine ERA (SAIC and URI, 1997), Table 5.2-1.

No samples found to be toxic to sea urchin fertilization.

Table A-4.4A. Elutriate Hazard Quotients[1] (ELU-HQs) for Derecktor Shipyard Marine ERA
stations exhibiting **NO TOXICITY**[2] to sea urchin (*Arbacia punctulata*) **normal larval development**.

Class	Analyte[3]	DSY-27	DSY-30	DSY-34	DSY-35	DSY-36	DSY-40	n	Mean	95% UCL[3]
MET	Arsenic					1.12	0.83	2.00	0.98	1.12
MET	Cadmium					0.01	0.01	2.00	0.01	0.01
MET	Chromium					8.00E-03	8.00E-03	2.00	8.00E-03	8.00E-03
MET	Copper					0.43	0.43	2.00	0.43	0.43
MET	Lead					0.98	1.06	2.00	1.02	1.06
MET	Mercury					4.00	4.00	2.00	4.00	4.00
MET	Nickel					0.48	0.48	2.00	0.48	0.48
MET	Silver					0.27	0.27	2.00	0.27	0.27
MET	Zinc					0.05	0.05	2.00	0.05	0.05
MET	SEM:AVS	2.42	1.10	0.29	0.20	0.29	0.43	6.00	0.79	1.70
PAH	1,6,7-Trimethylnaphthalene							0		
PAH	1-Methylnaphthalene							0		
PAH	1-Methylphenanthrene							0		
PAH	2,6-Dimethylnaphthalene							0		
PAH	2-Methylnaphthalene					6.57E-03	4.88E-03	2.00	5.72E-03	6.57E-03
PAH	Acenaphthene	2.75E-06				2.77E-06	3.45E-06	3.00	2.99E-06	3.45E-06
PAH	Acenaphthylene	3.70E-03				6.52E-03	0.01	3.00	6.92E-03	0.01
PAH	Anthracene					0.02	0.05	2.00	0.03	0.05
PAH	Benzo(a)anthracene					0.10	0.19	2.00	0.14	0.19
PAH	Benzo(a)pyrene	0.15				0.18	0.28	3.00	0.20	0.28
PAH	Benzo(b)fluoranthene							0		
PAH	Benzo(e)pyrene							0		
PAH	Benzo(g,h,i)perylene							0		
PAH	Benzo(k)fluoranthene							0		
PAH	Biphenyl							0		
PAH	Chrysene					0.05	0.06	2.00	0.05	0.06
PAH	Dibenz(a,h)anthracene	6.84				0.35	0.96	3.00	2.72	6.84
PAH	Fluoranthene	1.06E-03				8.32E-04	1.19E-03	3.00	1.03E-03	1.19E-03
PAH	Fluorene	0.04				0.01	0.01	3.00	0.02	0.04
PAH	Indeno(1,2,3-cd)pyrene							0		
PAH	Naphthalene					1.55E-05	1.24E-05	2.00	1.39E-05	1.55E-05
PAH	Perylene							0		
PAH	Phenanthrene	0.01				0.01	0.01	3.00	0.01	0.01
PAH	Pyrene	0.32				0.05	0.44	3.00	0.27	0.44
PAH	LMW PAHs	0.06				0.05	0.08	3.00	0.06	0.08
PAH	HMW PAHs	7.32				0.74	1.92	3.00	3.33	7.32
PAH	Total PAHs	7.37				0.79	2.00	3.00	3.39	7.37
PCB	Total PCBs	2.31				0.88	1.22	3.00	1.47	2.31
PST	Aldrin	5.37E-03				9.82E-03	9.82E-03	3.00	8.33E-03	9.82E-03
PST	Hexachlorobenzene	3.01E-05				2.45E-04	3.03E-05	3.00	1.02E-04	2.45E-04
PST	Mirex	0.09				0.60	0.10	3.00	0.26	0.60
PST	o,p'-DDE	2.80				2.04	2.48	3.00	2.44	2.80
PST	p,p'-DDE	0.42				0.39	0.59	3.00	0.47	0.59

1 - ELU-HQ data from Table A-4.2.
2 - Toxicity data contained in Derecktor Shipyard Marine ERA (SAIC and URI, 1997), Table 5.2-1.
3 - 95% Upper Confidence Limit based on sample size as follows: Mean+($t_{0.975}$(df)*(STDEV/SQRT(n))); where STDEV=standard deviation;
n=sample size; $t_{0.975}$(df)=sample size-dependent percentage points of the t distribution (Ott, 1993). Maximum values or
range taken where no.samples≤3.

Table A-4.4B. Elutriate Hazard Quotients[1] (ELU-HQs) for Derecktor Shipyard Marine
ERA stations exhibiting **TOXICITY**[2] to sea urchin (*Arbacia punctulata*) normal larval development.

Class	Analyte	DSY-25	DSY-29	DSY-31	DSY-32	DSY-33	DSY-37	DSY-38	DSY-39	n	Mean	Maximum HQ
MET	Arsenic	0.34		0.76	0.69	0.07	0.54	1.13	2.11	7.00	0.81	2.11
MET	Cadmium	0.01		0.01	0.01	0.01	0.01	0.01	0.01	7.00	0.01	0.01
MET	Chromium	8.00E-03		8.00E-03	8.00E-03	8.00E-03	8.00E-03	8.00E-03	8.00E-03	7.00	8.00E-03	8.00E-03
MET	Copper	0.43		1.76	0.43	0.43	0.43	0.43	0.43	7.00	0.62	1.76
MET	Lead	1.11		1.00	1.11	1.87	1.52	1.26	1.72	7.00	1.37	1.87
MET	Mercury	4.00		4.00	4.00	4.00	4.00	4.00	4.00	7.00	4.00	4.00
MET	Nickel	0.48		0.48	0.48	0.48	0.48	0.48	0.48	7.00	0.48	0.48
MET	Silver	0.27		0.27	0.27	0.27	0.27	0.27	0.27	7.00	0.27	0.27
MET	Zinc	0.05		0.05	0.05	0.05	0.05	0.05	0.05	7.00	0.05	0.05
MET	SEM:AVS	0.58	1.51	0.56	0.54	0.37	0.55	0.38	0.49	8.00	0.62	1.51
PAH	1,6,7-Trimethylnaphthalene									0		
PAH	1-Methylnaphthalene									0		
PAH	1-Methylphenanthrene									0		
PAH	2,6-Dimethylnaphthalene									0		
PAH	2-Methylnaphthalene	0.01		5.21E-03	5.49E-03	0.01	7.10E-03	6.94E-03	5.80E-03	7.00	7.81E-03	0.01
PAH	Acenaphthene	3.90E-05	5.56E-06	3.13E-06	3.74E-06	3.13E-06	2.39E-06	2.91E-06	3.01E-06	8.00	7.86E-06	3.90E-05
PAH	Acenaphthylene	0.03	3.70E-03	6.30E-03	8.54E-03	0.01	3.49E-03	2.41E-03	4.75E-03	8.00	9.00E-03	0.03
PAH	Anthracene	0.16	0.03	0.02	0.03	0.03	0.02	0.01	0.02	8.00	0.04	0.16
PAH	Benzo(a)anthracene	0.71	0.65	0.13	0.12	0.18	0.07	0.06	0.07	8.00	0.25	0.71
PAH	Benzo(a)pyrene	0.97	0.38	0.26	0.27	0.41	0.09	0.04	0.18	8.00	0.32	0.97
PAH	Benzo(b)fluoranthene									0		
PAH	Benzo(e)pyrene									0		
PAH	Benzo(g,h,i)perylene									0		
PAH	Benzo(k)fluoranthene									0		
PAH	Biphenyl									0		
PAH	Chrysene	0.33		0.04	0.04	0.13	0.03	0.02	0.04	7.00	0.09	0.33
PAH	Dibenz(a,h)anthracene	4.91	6.84	1.18	2.68	2.26	0.83	6.84	6.84	8.00	4.05	6.84
PAH	Fluoranthene	4.89E-03	7.36E-03	7.07E-04	7.79E-04	1.58E-03	7.83E-04	6.87E-04	7.51E-04	8.00	2.19E-03	7.36E-03
PAH	Fluorene	0.18	0.04	0.01	0.02	0.03	0.01	0.02	0.01	8.00	0.04	0.18
PAH	Indeno(1,2,3-cd)pyrene									0		
PAH	Naphthalene	2.36E-05		8.45E-06	1.88E-05	2.07E-05	1.33E-05	1.76E-05	1.07E-05	7.00	1.61E-05	2.36E-05
PAH	Perylene									0		
PAH	Phenanthrene	0.04	0.01	0.01	0.01	0.02	0.02	0.01	0.01	8.00	0.02	0.04
PAH	Pyrene	0.36	0.49	0.14	0.13	0.05	0.04	0.02	0.02	8.00	0.16	0.49
PAH	LMW PAHs	0.39	0.09	0.05	0.07	0.09	0.05	0.05	0.05	8.00	0.10	0.39
PAH	HMW PAHs	7.29	8.37	1.76	3.23	3.03	1.07	6.99	7.16	8.00	4.86	8.37
PAH	Total PAHs	7.68	8.46	1.81	3.30	3.13	1.12	7.03	7.21	8.00	4.97	8.46
PCB	Total PCBs	2.59	1.81	1.96	1.30	0.89	1.25	0.64	0.86	8.00	1.41	2.59
PST	Aldrin	9.82E-03	5.79E-03	9.82E-03	9.82E-03	9.82E-03	9.82E-03	9.82E-03	9.82E-03	8.00	9.31E-03	9.82E-03
PST	Hexachlorobenzene	2.14E-05	2.45E-04	7.19E-05	1.58E-05	2.27E-05	1.36E-05	1.38E-05	1.45E-05	8.00	5.23E-05	2.45E-04
PST	Mirex	0.40	0.71	0.60	0.13	0.60	0.09	0.10	0.05	8.00	0.34	0.71
PST	o,p'-DDE	3.52	2.97	3.21	1.96	1.33	3.39	1.44	2.25	8.00	2.50	3.52
PST	p,p'-DDE	0.42	0.63	0.64	0.30	0.31	0.71	0.25	0.61	8.00	0.48	0.71

1 - Hazard Quotients from Table A-4.2.
2 - Toxicity data contained in Derecktor Shipyard Marine ERA (SAIC and URI, 1997), Table 5.2-1.

Table A-5. Comparing aquatic Threshold Effects Value Hazard Quotients[1] for CoCs in porewaters and elutriates for identification of Limiting CoCs for the Derecktor Shipyard/Coddington Cove study area.

Class	Analyte[3,4]	Aquatic Pathway[2]	Aquatic TEV (µg/L)	DSY-25	DSY-26	DSY-27	DSY-28	DSY-29	DSY-30	DSY-31	DSY-32	DSY-33	DSY-34	DSY-35	DSY-36	DSY-37	DSY-38	DSY-39	DSY-40	DSY-41
PAH	HMW PAHs	PW	0.81	0.89	1.42	1.06	0.39	2.34	1.15	0.46	0.58	0.17	0.20	0.03	0.34	0.39	0.21	0.24	1.74	0.14
PCB	Total PCBs	PW	0.03	0.15	0.16	1.78	0.06	0.08	0.15	0.13	0.12	0.05	0.04	0.04	0.06	0.08	0.04	0.04	0.08	0.06
	SUM TEV-HQ			1.04	1.58	2.84	0.45	2.42	1.30	0.59	0.70	0.22	0.24	0.07	0.40	0.47	0.25	0.28	1.82	0.21
	MAX TEV-HQ			0.89	1.42	1.78		2.34	1.15										1.74	
	Limiting CoC			HMW PAHs	HMW PAHs	Total PCBs		HMW PAHs	HMW PAHs										HMW PAHs	
MET	Arsenic	ELU	40.40	0.31						0.67	0.61	0.06			1.00	0.49	1.01	1.88	0.74	
MET	Copper	ELU	2.90	0.43						1.76	0.43	0.43			0.43	0.43	0.43	0.43	0.43	
MET	Lead	ELU	13.20	0.71						0.64	0.71	1.20			0.63	0.98	0.81	1.11	0.68	
PAH	HMW PAHs	ELU	2.09	0.21		0.11		0.24		0.06	0.06	0.05			0.03	0.03	0.02	0.03	0.16	
PAH	Total PAHs	ELU	37.51	0.02		6.79E-03		0.01		4.14E-03	4.25E-03	4.14E-03			2.68E-03	2.34E-03	2.06E-03	2.24E-03	9.77E-03	
PCB	Total PCBs	ELU	0.07	1.12		1.00		0.78		0.85	0.56	0.38			0.38	0.54	0.28	0.37	0.53	
PST	o,p'-DDE	ELU	3.59E-03	0.98		0.78		0.83		0.89	0.53	0.37			0.57	0.94	0.40	0.62	0.69	
	SUM TEV-HQ			3.76	0	1.89	0	1.85	0	4.88	2.91	2.50	0	0	3.04	3.40	2.95	4.44	3.23	0
	MAX TEV-HQ			1.12		1.00		0.83		1.76	0.71	1.20			1.00	0.98	1.01	1.88	0.74	
	Limiting CoC			Total PCBs		Total PCBs		o,p'-DDE		Copper	Lead	Lead			Arsenic	Lead	Arsenic	Arsenic	Arsenic	

1 - Threshold Effects Value Hazard Quotient (TEV-HQ) = CoC concentration/Threshold Effect Value (TEV) (Table 7).

2 - PW - bedded sediment exposure pathway, CoCs measured in porewater (PW; Table A-3.1a); ELU- Resuspended sediment exposure pathway, CoCs measured in sediment elutriates (ELU; Table A-4.1).

3 - TEV units: µg/g dry weight for metals, ng/g dry weight for organics.

4 - Sum TEV-HQ = sum of TEV-HQs for all analytes at a given station.

   Max TEV-HQ = maximum TEV-HQs observed for all analytes at a given station.

Table A-6. Avian predator Threshold Effects Value Hazard Quotients[1] for CoCs in tissue of prey species consumed by avian aquatic predators in the Derecktor Shipyard/Coddington Cove study area.

Class	Analyte[2]	Avian TEV[3]	DSY-24-IBM	DSY-25-IBM	DSY-25-LOB	DSY-26-CN	DSY-26-DM	DSY-26-IBM	DSY-27-IBM	DSY-27-LOB	DSY-28-CN	DSY-28-DM	DSY-28-IBM	DSY-28-LOB	DSY-29-CN	DSY-29-DM	DSY-29-LOB	DSY-31-DM	DSY-31-PM	DSY-32-PM	DSY-33-DM	DSY-33-LOB	DSY-33-PM	DSY-34-PM
MET	Arsenic	14.96	0.68	0.84	1.91	0.24	0.36	0.55	0.45	1.15	0.33	1.13	0.18		0.51	0.60	1.91	0.35	0.63	0.33	0.83	1.49	0.39	0.58
MET	Cadmium	1.83	1.02	0.66	0.20	0.45	0.51	0.40	0.42	0.14	0.60	0.42	0.34		0.63	0.44	0.26	0.29	0.43	0.32	0.51	0.09	0.36	0.39
MET	Chromium	3.08	1.02	0.97	0.54	0.45	0.70	0.79	0.93	0.69	0.31	0.77	0.83		0.38	0.66	0.56	0.74	0.64	0.57	0.82	0.65	0.60	0.69
MET	Copper	60.71	0.07	0.20	2.50	0.29	0.22	0.13	0.25	2.75	0.25	0.18	0.02		0.36	0.10	1.65	0.15	0.24	0.18	0.14	0.99	0.14	0.17
MET	Lead	3.11	1.87	9.65E-05	0.05	0.25	0.44	9.65E-05	0.97	0.02	9.65E-05	9.65E-05	9.65E-05		0.29	0.30	0.07	0.43	0.56	0.89	0.47	0.15	9.65E-05	0.53
MET	Mercury	0.38	0.73	0.46	0.69	0.34	0.43	0.31	0.39	1.19	0.27	0.35	0.38		0.44	0.44	0.75	0.38	0.36	0.41	0.27	0.60	0.32	0.31
MET	Silver	1.41	7.12E-05	7.12E-05	3.89	0.37	7.12E-05	7.12E-05	7.12E-05	4.89	0.22	0.84	7.12E-05		7.12E-05	7.12E-05	4.16	7.12E-05	7.12E-05	0.98	7.12E-05	2.44	7.12E-05	7.12E-05
MET	Zinc	124	0.62	0.91	0.71	0.34	0.83	0.74	1.15	0.91	0.21	0.77	0.98		0.23	0.61	1.05	1.33	0.71	0.91	0.99	0.85	0.82	0.75
PCB	Total PCBs	766	0.80	0.69	0.61	2.87	2.32	1.08	1.50	0.98	5.05	0.90	1.05	1.12	4.14	1.13	0.46	1.03	1.24	0.48	0.83	0.61	0.68	0.41
	MAX TEV-HQ		1.87	0.97	3.89	2.87	2.32	1.08	1.50	4.89	5.05	1.13	1.05	1.12	4.14	1.13	4.16	1.33	1.24	0.98	0.99	2.44	0.82	0.75
	MAX CoC[4]		Lead		Silver	Total PCBs	Total PCBs	Total PCBs	Total PCBs	Silver	Total PCBs	Arsenic	Total PCBs	Total PCBs	Total PCBs	Total PCBs	Silver	Zinc	Total PCBs	Silver		Silver		
	Limiting CoC		Lead	Silver	Silver	Total PCBs	Total PCBs	Total PCBs	Silver	Silver	Total PCBs	Total PCBs	Total PCBs	Total PCBs	Silver	Silver	Silver	Zinc	Zinc			Silver		

1 - Threshold Effects Value Hazard Quotient (TEV-HQ) = CoC concentration (Table A-2.4)/Threshold Effect Value (TEV) (Table 9).
2 - Sum TEV-HQ = sum of TEV-HQs for all analytes at a given station.
   Max TEV-HQ = maximum TEV-HQs observed for all analytes at a given station.
3 - TEV units: µg/g dry weight for metals, ng/g dry weight for organics.
4 - CoC associated with maximum observed TEV-HQ by sample.

Table A-6 (continued). Avian predator Threshold Effects Value Hazard Quotients[1] for CoCs in tissue of prey species consumed by avian aquatic predators in the Derecktor Shipyard/Coddington Cove study area.

Class	Analyte[2]	Avian TEV[3]	DSY-35-IBM	DSY-35-LOB	DSY-35-MM	DSY-35-PM	DSY-36-CN	DSY-36-IBM	DSY-36-LOB	DSY-36-PM	DSY-37-PM	DSY-38-DM	DSY-38-LOB	DSY-38-PM	DSY-39-DM	DSY-39-LOB	DSY-40-DM	DSY-40-IBM	DSY-41-MM	DSY-41-PM
MET	Arsenic	14.96	0.42	1.09	0.43	0.57	0.24	0.41	1.33	0.50	0.50	0.41	1.74	0.41	0.60	1.25	0.40	0.35	0.50	0.14
MET	Cadmium	1.83	0.40	0.31	0.35	0.36	0.53	0.21	1.64E-04	0.45	0.35	0.34	0.27	0.32	0.17	0.16	0.33	0.34	0.49	0.39
MET	Chromium	3.08	0.72	0.70	0.77	0.65	0.28	0.92	0.64	0.80	0.56	0.85	0.63	0.60	0.97	0.53	0.88	0.72	0.57	0.63
MET	Copper	60.71	0.12	2.11	0.11	0.14	0.26	0.12	0.81	0.20	0.15	0.19	2.72	0.17	0.14	3.24	0.10	0.12	0.22	0.20
MET	Lead	3.11	0.56	0.24	9.65E-05	0.53	0.31	9.65E-05	0.11	0.70	0.95	0.62	0.08	9.65E-05	9.65E-05	0.06	0.95	0.78	0.52	9.65E-05
MET	Mercury	0.38	0.44	0.70	0.32	0.26	0.38	0.50	0.86	0.39	0.40	0.34	0.86	0.44	0.37	1.08	0.34	0.43	0.31	0.39
MET	Silver	1.41	7.12E-05	4.65	7.12E-05	7.12E-05	7.12E-05	7.12E-05	2.04	7.12E-05	0.46	1.22	4.34	7.12E-05	0.70	0.58	7.12E-05	7.12E-05	0.90	7.12E-05
MET	Zinc	124	1.05	0.89	0.90	1.01	0.44	0.68	0.93	0.98	0.86	0.72	1.39	1.06	1.06	1.04	0.95	0.85	0.53	0.68
PCB	Total PCBs	766	0.91	0.41	0.21	0.63	4.08	1.17	1.10	0.64	0.56	0.72	0.38		0.60	0.84	0.73	1.19	0.33	0.36
	MAX TEV-HQ		1.05	4.65	0.90	1.01	4.08	1.17	2.04	0.98	0.95	1.22	4.34	1.06	1.06	3.24	0.95	1.19	0.90	0.68
	MAX CoC[4]		Zinc	Silver		Zinc	Total PCBs	Total PCBs	Silver			Silver	Silver	Zinc	Zinc	Copper		Total PCBs		
	Limiting CoC		Silver				Total PCBs					Silver			Copper		Total PCBs			

1 - Threshold Effects Value Hazard Quotient (TEV-HQ) = CoC concentration (Table A-2.4)/Threshold Effect Value (TEV) (Table 9).
2 - Sum TEV-HQ = sum of TEV-HQs for all analytes at a given station.
    Max TEV-HQ = maximum TEV-HQs observed for all analytes at a given station.
3 - See Table 14 for TEVs. TEV units: µg/g dry weight for metals, ng/g dry weight for organics.
4 - CoC associated with maximum observed TEV-HQ by sample.

Table A-7. Human Health Threshold Effects Value Hazard Quotients[1] based on concentrations of selected contaminants in tissues of shellfish harvested from lower Narragansett Bay for consumption by subsistence fishermen.

Class	Analyte[2]	HH TEV[3]	DSY-24-IBM	DSY-25-IBM	DSY-25-LOB	DSY-26-DM	DSY-26-IBM	DSY-27-IBM	DSY-27-LOB	DSY-28-DM	DSY-28-IBM	DSY-28-LOB	DSY-29-DM	DSY-29-LOB	DSY-31-DM	DSY-31-PM	DSY-32-PM	DSY-33-DM	DSY-33-LOB	DSY-33-PM	DSY-34-PM
MET	Arsenic	17.27	0.59	0.73	1.66	0.31	0.48	0.39	1.00	0.98	0.16		0.52	1.65	0.30	0.54	0.28	0.72	1.29	0.34	0.50
PAH	Benzo(a)anthracene	107	0.14	2.63	0.03	0.71	9.74	2.71	0.27	0.40	0.67	0.23	0.50	0.03	0.55	1.24	0.74	0.03	0.03	0.33	0.43
PAH	Benzo(a)pyrene	10.68	0.74	10.72	0.34	0.34	51.30	6.84	2.69	0.34	3.17	2.34	0.34	1.22	0.34	4.21	3.99	0.34	0.34	2.08	2.10
PAH	Dibenz(a,h)anthracene	10.68	0.74	1.27	0.05	0.05	4.65	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
PAH	Indeno(1,2,3-cd)pyrene	107	0.11	0.33	0.01	0.01	1.13	0.25	0.08	0.01	0.01	0.01	0.01	0.10	0.01	0.19	0.25	0.01	0.01	0.08	0.07
PCB	Total PCBs	1300	0.47	0.41	0.36	1.37	0.64	0.88	0.58	0.53	0.62	0.66	0.67	0.27	0.60	0.73	0.28	0.49	0.36	0.40	0.24
	MAX TEV-HQ		0.74	10.72	1.66	1.37	51.30	6.84	2.69	0.98	3.17	2.34	0.67	1.65	0.60	4.21	3.99	0.72	1.29	2.08	2.10
	MAX CoC[4]		Dibenz(a,h)anthracene	Benzo(a)pyrene	Arsenic	Total PCBs	Benzo(a)pyrene	Benzo(a)pyrene	Benzo(a)pyrene	Arsenic	Benzo(a)pyrene	Benzo(a)pyrene	Total PCBs	Arsenic	Total PCBs	Benzo(a)pyrene	Benzo(a)pyrene	Arsenic	Arsenic	Benzo(a)pyrene	Benzo(a)pyrene
	Limiting CoC			Benzo(a)pyrene		Benzo(a)pyrene		Benzo(a)pyrene			Benzo(a)pyrene			Arsenic		Benzo(a)pyrene	Benzo(a)pyrene		Benzo(a)pyrene		Benzo(a)pyrene

1 - Threshold Effects Value Hazard Quotient (TEV-HQ) = CoC concentration (Table A-2.4)/Threshold Effect Value (TEV) (Table 14).

2 - Sum TEV-HQ = sum of TEV-HQs for all analytes at a given station.

    Max TEV-HQ = maximum TEV-HQs observed for all analytes at a given station.

3 - TEV units: µg/g dry weight for metals, ng/g dry weight for organics.

4 - CoC associated with maximum observed TEV-HQ by sample.

5 - Arsenic selected as L-CoC for this station (see Text Section 2.4).

Table A-7 (continued). Human Health Threshold Effects Value Hazard Quotients[1] based on concentrations of selected contaminants in tissues of shellfish harvested from lower Narragansett Bay for consumption by subsistence fishermen.

Class	Analyte[2]	HH TEV[3]	DSY-35-IBM	DSY-35-LOB	DSY-35-MM	DSY-35-PM	DSY-36-IBM	DSY-36-LOB	DSY-36-PM	DSY-37-PM	DSY-38-DM	DSY-38-LOB	DSY-38-PM	DSY-39-DM	DSY-39-LOB	DSY-40-DM	DSY-40-IBM	DSY-41-MM	DSY-41-PM
MET	Arsenic	17.27	0.36	0.94	0.37	0.49	0.36	1.15	0.43	0.43	0.35	1.51	0.35	0.52	1.08	0.35	0.31	0.43	0.13
PAH	Benzo(a)anthracene	107	0.29	0.03	0.15	0.20	0.28	0.03	0.62	0.52	0.14	0.03	0.43	0.17	0.03	0.39	0.23		0.39
PAH	Benzo(a)pyrene	10.68	0.34	0.34	0.65	1.51	1.17	0.34	3.02	2.17	0.76	0.34	1.93	0.34	0.34	0.34	0.58	1.04	1.62
PAH	Dibenz(a,h)anthracene	10.68	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	3.10	0.05	0.05	0.05	0.05	0.05
PAH	Indeno(1,2,3-cd)pyrene	107	0.10	0.01	0.01	0.01	0.06	0.01	0.10	0.01	0.01	0.01	0.09	0.26	0.01	0.01	0.01	0.01	0.01
PCB	Total PCBs	1300	0.54	0.24	0.12	0.37	0.69	0.65	0.38	0.33	0.42	0.22		0.35	0.50	0.43	0.70	0.19	0.21
	MAX TEV-HQ		0.54	0.94	0.65	1.51	1.17	1.15	3.02	2.17	0.76	1.51	1.93	3.10	1.08	0.43	0.70	1.04	1.62
	MAX CoC[4]		Total PCBs	Arsenic	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Arsenic	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Arsenic	Benzo(a) pyrene	Dibenz(a,h)anthracene	Arsenic	Total PCBs	Total PCBs	Benzo(a) pyrene	Benzo(a) pyrene
	Limiting CoC		Benzo(a)pyrene				Benzo(a)pyrene			Benzo(a) pyrene	Benzo(a)pyrene			Arsenic[5]				Benzo(a)pyrene	

1 - Threshold Effects Value Hazard Quotient (TEV-HQ) = CoC concentration (Table A-2.4)/Threshold Effect Value (TEV) (Table 14).

2 - Sum TEV-HQ = sum of TEV-HQs for all analytes at a given station.
 Max TEV-HQ = maximum TEV-HQs observed for all analytes at a given station.

3 - TEV units: µg/g dry weight for metals, ng/g dry weight for organics.

4 - CoC associated with maximum observed TEV-HQ by sample.

5 - Arsenic selected as L-CoC for this station (see Text Section 2.4).

Table A-8. Derivation of aquatic PRGs for CoCs in porewaters and elutriates obtained from sediments collected in the Derecktor Shipyard/Coddington Cove study area[1].

Class	Analyte[2]	Aquatic Pathway[3]	DSY-25	DSY-26	DSY-27	DSY-28	DSY-29	DSY-30	DSY-31	DSY-32	DSY-33	DSY-34	DSY-35	DSY-36	DSY-37	DSY-38	DSY-39	DSY-40	DSY-41	n	PRG Mean[3,4]
PAH	HMW PAHs	PW	4886	3700	9589	10922	12858	8969	10129	9146	4530	8530	1738	9776	4996	7048	6710	2826	1819	17.00	6951
PCB	Total PCBs	PW	638	621	1855	2354	6788	2117	1668	1616	783	1767	172	1891	1205	1643	1443	1056	222	17.00	1638
MET	Arsenic	ELU	20.72						15.18	17.81	119			11.21	15.27	8.87	4.03	9.14		9.00	24.63
MET	Copper	ELU	54.52						45.92	155	40.02			125	62.64	64.96	46.40	69.02		9.00	73.74
MET	Lead	ELU	50.41						126	175	33.21			125	58.22	76.73	48.82	61.75		9.00	83.94
PCB	Total PCBs	ELU	83.53		3310		699		261	357	104			300	185	215	156	159		11.00	530
PST	o,p'-DDE	ELU	0.10		83.81		5.99		4.06	0.49	1.71			0.44	0.11	0.25	1.14	1.55		11.00	9.06

1 - Station-specific estimate of PRG = sediment concentration (Table A-2.1)/TEV-HQ (Table A-5).

2 - Analytes include Limiting CoCs identified in Table A-5.

3 - PW - bedded sediment exposure pathway, CoCs measured in porewater (PW); ELU- Resuspended sediment exposure pathway, CoCs measured in sediment elutriates (ELU).

4 - Baseline PRG calculated as the mean of station-specific estimates.

Table A-9. Comparison of sediment concentrations measured in URI (Quinn et al., 1994) and ERA (1997) investigations of the Derecktor Shipyard/Coddington Cove study area[1].

Class	Analyte	DSY-1	DSY-40	RPD²	DSY-1	DSY-41	RPD	DSY-2	DSY-28	RPD	DSY-3	DSY-29	RPD	DSY-10	DSY-41	RFP	DSY-11	DSY-31	RPD	DSY-18	DSY-26	RPD
Metals	Arsenic		6.79			11.43			8.68			12.46			11.43			10.22			9.43	
	Cadmium	0.20	0.50	-0.85	0.20	0.18	0.11	0.15	0.55	-1.13	1.00	1.45	-0.37	0.07	0.18	-0.86	0.31	0.76	-0.84	0.22	0.18	0.21
	Chromium	95.99	44.50	0.73	95.99	36.75	0.89	152	80.50	0.62	195	86.50	0.77	60.85	36.75	0.49	132	76.75	0.53	107	53.50	0.66
	Copper	45.52	29.75	0.42	45.52	9.25	1.32	197	71.75	0.93	262	158	0.50	12.47	9.25	0.30	81.46	80.75	0.01	81.67	39.25	0.70
	Lead	35.39	42.10	-0.17	35.39	17.00	0.70	181	77.70	0.80	201	186	0.08	22.13	17.00	0.26	46.08	81.00	-0.55	60.23	40.40	0.39
	Mercury		0.19			0.02			0.32	-2.00		0.50			0.02			0.40			0.14	
	Nickel	38.60	17.25	0.76	38.60	14.50	0.91	85.28	24.25	1.11	128	34.75	1.15	31.42	14.50	0.74	168	24.75	1.49	25.36	20.50	0.21
	Silver	0.60	0.21	0.95	0.60	0.07	1.61	0.82	0.51	0.46	1.27	0.79	0.47	0.56	0.07	1.59	1.22	0.51	0.82	0.16	0.19	-0.16
	Zinc	149	100	0.39	149	47.25	1.04	593	169	1.11	1231	393	1.03	63.84	47.25	0.30	1104	167	1.47	163	102	0.47
	SEM-AVS																					
PAHs	1,6,7-Trimethylnaphthalene	2.36	4.66	-0.66	2.36	0.45	1.36	10.10	8.41	0.18	51.69	27.94	0.60	1.01	0.45	0.77	8.15	7.90	0.03	1.01	4.34	-1.25
	1-Methylnaphthalene	6.84	9.41	-0.32	6.84	1.27	1.37	0.50	19.85	-1.90	9.71	50.07	-1.35		1.27		10.97	20.42	-0.60		7.83	
	1-Methylphenanthrene	27.68	38.26	-0.32	27.68	2.22	1.70	368	38.57	1.62	441	267	0.49	1.27	2.22	-0.54	51.06	32.53	0.44	228	43.54	1.36
	2,6-Dimethylnaphthalene	6.56	17.33	-0.90	6.56	2.36	0.94	7.55	34.23	-1.28	23.04	112	-1.32		2.36		12.33	34.64	-0.95		18.65	
	2-Methylnaphthalene	0	16.39	-2.00		2.01		2.47	43.87	-1.79	8.22	73.47	-1.60	0.74	2.01	-0.93	6.93	36.86	-1.37		13.86	
	Acenaphthene	18.26	16.20	0.12	18.26	1.71	1.66	63.47	17.27	1.14	193	189	0.02	2.29	1.71	0.29	20.89	17.14	0.20	14.84	12.21	0.19
	Acenaphthylene	58.86	95.65	-0.48	58.86	0.77	1.95	427	74.63	1.40	867	300	0.97	1.03	0.77	0.29	57.61	71.00	-0.21	167	93.84	0.56
	Anthracene	201	234	-0.15	201	11.10	1.79	1330	183	1.52	3360	1220	0.93	17.37	11.10	0.44	254	200	0.24	753	268	0.95
	Benzo(a)anthracene	166	234	-0.34	166	13.76	1.69	7380	294	1.85	10600	2700	1.19	26.14	13.76	0.62	274	281	-0.02	898	518	0.54
	Benzo(a)pyrene	164	317	-0.64	164	18.55	1.59	3320	377	1.59	4710	2380	0.66	38.47	18.55	0.70	206	421	-0.68	1190	434	0.93
	Benzo(b)fluoranthene	358			358			10100			9230			70.46			381			1890		
	Benzo(e)pyrene	273	333	-0.20	273	19.44	1.73	5140	362	1.74	5600	1950	0.97	40.07	19.44	0.69	257	401	-0.44	1020	365	0.95
	Benzo(g,h,i)perylene	97.41	184	-0.61	97.41	12.18	1.56	2070	247	1.57	3060	1110	0.94	29.52	12.18	0.83	132	215	-0.48	563	201	0.95
	Benzo(k)fluoranthene	224	836	-1.16	224	47.26	1.30	2070	911	0.78	1980	5350	-0.92	24.16	47.26	-0.65	245	1040	-1.24	899	999	-0.11
	Biphenyl	5.01	6.02	-0.18	5.01	0.66	1.53	12.81	12.61	0.02	40.77	29.91	0.31	0	0.66	-2.00	18.53	14.41	0.25	9.37	6.66	0.34
	Chrysene	406	444	-0.09	406	20.65	1.81	4980	364	1.73	6390	2800	0.78	47.47	20.65	0.79	538	399	0.30	1460	592	0.85
	Dibenz(a,h)anthracene	21.20	52.77	-0.85	21.20	3.18	1.48	784	66.60	1.69	1460	317	1.29	9.34	3.18	0.99	28.43	62.93	-0.76	243	61.34	1.19
	Fluoranthene	1050	779	0.30	1050	37.83	1.86	12000	459	1.85	13600	4970	0.93	94.27	37.83	0.85	1320	399	1.07	1590	686	0.79
	Fluorene	42.73	19.09	0.76	42.73	2.09	1.81	439	31.45	1.73	859	294	0.98	0.92	2.09	-0.78	74.94	28.12	0.91	92.44	53.89	0.53
	Indeno(1,2,3-cd)pyrene	99.85	166	-0.50	99.85	11.44	1.59	1720	223	1.54		1020		18.33	11.44	0.46	132	218	-0.49	529	209	0.87
	Naphthalene	0.27	21.00	-1.95	0.27	1.84	-1.49	1.97	37.54	-1.80	2.94	76.08	-1.85	1.90	1.84	0.03	11.75	45.30	-1.18		16.16	
	Perylene	57.17	78.70	-0.32	57.17	7.31	1.55	1050	133	1.55	1336	611	0.74	22.57	7.31	1.02	95.53	142	-0.39	311	133	0.80
	Phenanthrene	305	304	0.00	305	20.16	1.75	3990	220	1.79	4890	1610	1.01	21.15	20.16	0.05	392	216	0.58	627	317	0.66
	Pyrene	794	1190	-0.40	794	49.54	1.76	9390	650	1.74	10100	5300	0.62	93.92	49.54	0.62	990	846	0.16	1640	740	0.76
	Low Molecular Weight PAHs	369	478	-0.26	369	26.49	1.73	2662	502	1.37	5856	2639	0.76	26.53	26.49	0.00	528	509	0.04	1266	539	0.81
	High Molecular Weight PAHs	4013	4917	-0.20	4013	261	1.76	63994	4308	1.75	72956	30118	0.83	536	261	0.69	4991	4840	0.07	12860	5256	0.84
	Sum of PAHs	4383	5395	-0.21	4383	288	1.75	66656	4809	1.73	78812	32757	0.83	562	288	0.65	5519	5149	0.07	14126	5795	0.84
PCBs	Total PCBs (Sum Congenersx2)	67.58	84.13	-0.22	67.58	13.75	1.32	209	134	0.44	733	546	0.29	11.73	13.75	-0.16	658	221	0.99	293	98.24	0.99
Pesticides	Aldrin		0.10			0.10		0.06	0.10	-0.57		0.10			0.10			0.10		0.09	0.10	-0.14
	Hexachlorobenzene		0.08			0.08		0.24	0.06	1.26	0.17	0.16	0.11		0.08			0.08		0.10	0.12	-0.12
	Mirex		0.23			0.10		0	0.17	-2.00		0.10			0.10			0.33		0.39	0.19	0.70
	o,p'-DDE	0.98	1.07	-0.09	0.98	0.40	0.84	5.71	1.67	1.09	3.81	4.96	-0.26	0.74	0.40	0.60	8.71	3.63	0.82	4.34	1.52	0.96
	p,p'-DDE	0.18	1.14	-1.44	0.18	0.08	0.82	3.13	2.03	0.42	13.61	6.29	0.74	3.46	0.08	1.91	1.45	1.95	-0.29		0.61	
TOC	% TOC	2.06	1.48	0.33	2.06	0.81	0.87	1.30	4.01	-1.02	2.63	6.09	-0.79	1.53	0.81	0.61	6.17	3.84	0.46	2.95	1.47	0.67
	All CoCs	-3.07E-01			1.35			0.69			0.37			0.33			2.72E-04			0.57		
	PRGs⁴	-4.37E-02			1.28			0.98			0.42			0.27			0.13			0.73		
	Station Separation Distance (m)	56.27			47.24			44.42			24.98			61.06			27.21			41.24		

1 - ERA Sediment data source: Table A-2.1A; URI Sediment data source: Table A-2.1B.
2 - RPD = Relative Percent Difference of co-located station sediment concentrations (URI vs. ERA, respectively). See Figure 3.2-1 for station locations.
3 - CV = Coefficient of Variation of mean RPD across station pairs.
4 - PRGs identified in Table 16 for aquatic exposure pathways.

Table A-9 (continued). Comparison of sediment concentrations measured in URI (Quinn et al., 1994) and ERA (1997) investigations of the Derecktor Shipyard/Coddington Cove study area[1].

Class	Analyte	DSY-19	DSY-32	RPD	DSY-20	DSY-31	RPD	DSY-21	DSY-33	RPD	All Data RPD Mean	All Data RPD STDEV	All Data RPD CV[3]	Sep. Dist. <30m RPD Mean	Sep. Dist. <30m RPD STDEV	Sep. Dist. <30m RPD CV[3]	Sep. Dist. >30m RPD Mean	Sep. Dist. >30m RPD STDEV	Sep. Dist. >30m RPD CV[3]
Metals	Arsenic		10.93			10.22			7.39										
	Cadmium	0.17	0.72	-1.23	0.25	0.76	-1.00	0.19	0.19	0.00	-5.95E-01	0.54	-0.90	-7.34E-01	0.33	-0.45	-0.53	0.62	-1.15
	Chromium	105	84.75	0.21	99.23	76.75	0.26	142	46.50	1.02	0.62	0.26	0.41	0.52	0.26	0.50	0.66	0.26	0.40
	Copper	66.91	66.75	0.00	79.68	80.75	-0.01	29.66	17.25	0.53	0.47	0.43	0.92	0.16	0.29	1.76	0.60	0.43	0.72
	Lead	57.82	125	-0.73	76.91	81.00	-0.05	41.83	40.00	0.04	0.08	0.49	6.37	-1.74E-01	0.33	-1.90	0.18	0.53	2.87
	Mercury		0.37			0.40			0.13										
	Nickel	22.79	25.75	-0.12	23.07	24.75	-0.07	7.91	18.25	-0.79	0.54	0.71	1.31	0.85	0.82	0.96	0.40	0.68	1.68
	Silver	0.40	0.81	-0.68	0.88	0.51	0.53	0.08	0.24	-0.97	0.46	0.86	1.87	0.61	0.19	0.31	0.40	1.04	2.61
	Zinc	139	201	-0.36	158	167	-0.06	175	72.25	0.83	0.62	0.57	0.92	0.82	0.79	0.97	0.54	0.51	0.94
	SEM-AVS																		
PAHs	1,6,7-Trimethylnaphthalene		7.89		4.30	7.90	-0.59	4.19	2.04	0.69	0.13	0.83	6.56	0.01	0.59	47.07	0.18	0.97	5.31
	1-Methylnaphthalene		17.57		0	20.42	-2.00	14.95	5.11	0.98	-5.45E-01	1.33	-2.44	-1.32E+00	0.70	-0.53	0.03	1.48	44.03
	1-Methylphenanthrene	311	51.57	1.43	421	32.53	1.71	15.41	8.88	0.54	0.84	0.84	1.00	0.88	0.72	0.81	0.83	0.94	1.14
	2,6-Dimethylnaphthalene		43.59			34.64		3.04	9.91	-1.06	-7.61E-01	0.85	-1.12	-1.13E+00	0.26	-0.23	-0.57	1.02	-1.78
	2-Methylnaphthalene		32.08			36.86		20.10	9.66	0.70	-1.16E+00	0.99	-0.85	-1.48E+00	0.16	-0.11	-1.00	1.23	-1.22
	Acenaphthene		14.29		17.13	17.14	0.00	7.12	3.31	0.73	0.48	0.56	1.19	0.07	0.11	1.48	0.69	0.61	0.89
	Acenaphthylene		131		64.60	71.00	-0.09	30.23	11.85	0.87	0.59	0.80	1.36	0.22	0.65	2.92	0.77	0.85	1.11
	Anthracene	789	298	0.91	922	200	1.29	99.90	31.49	1.04	0.90	0.59	0.66	0.82	0.53	0.65	0.93	0.65	0.70
	Benzo(a)anthracene	399	388	0.03	1420	281	1.34	196	50.03	1.19	0.81	0.76	0.94	0.83	0.75	0.89	0.80	0.82	1.03
	Benzo(a)pyrene	496	495	0.00	880	421	0.71	110	67.95	0.47	0.53	0.79	1.48	0.23	0.79	3.48	0.66	0.81	1.22
	Benzo(b)fluoranthene	1050			1500			159											
	Benzo(e)pyrene	576	417	0.32	743	401	0.60	88.94	63.45	0.33	0.67	0.72	1.08	0.38	0.73	1.94	0.80	0.73	0.92
	Benzo(g,h,i)perylene	280	287	-0.10	280	215	0.26	134	50.33	0.91	0.58	0.78	1.34	0.24	0.71	2.93	0.73	0.81	1.12
	Benzo(k)fluoranthene	791	1100	-0.33	2300	1040	0.75	47.04	155	-1.07	-2.63E-01	0.92	-3.49	-4.68E-01	1.07	-2.29	-0.18	0.92	-5.27
	Biphenyl		15.37			14.41		5.62	3.18	0.55	0.10	0.99	9.72	0.28	0.04	0.14	0.04	1.17	27.10
	Chrysene	1170	491	0.82	1580	399	1.19	122	58.78	0.70	0.89	0.58	0.65	0.76	0.45	0.59	0.94	0.66	0.69
	Dibenz(a,b)anthracene	39.28	72.22	-0.59	56.80	62.93	-0.10	43.99	12.41	1.12	0.54	1.00	1.84	0.14	1.04	7.30	0.72	1.01	1.41
	Fluoranthene	1830	535	1.09	5850	399	1.74	325	95.23	1.09	1.16	0.51	0.44	1.25	0.44	0.35	1.12	0.57	0.51
	Fluorene		25.73		216	28.12	1.54	29.36	6.57	1.27	0.97	0.79	0.81	1.14	0.34	0.30	0.89	0.96	1.08
	Indeno(1,2,3-cd)pyrene	255	264	-0.03	276	218	0.24	99.71	45.31	0.75	0.49	0.77	1.58	-1.29E-01	0.52	-4.00	0.67	0.77	1.15
	Naphthalene		42.67		9.13	45.30	-1.33	2.98	10.87	-1.14	-1.34E+00	0.63	-0.47	-1.45E+00	0.35	-0.24	-1.27	0.79	-0.62
	Perylene	244	150	0.48	300	142	0.72	54.42	23.92	0.78	0.69	0.65	0.94	0.36	0.65	1.80	0.84	0.65	0.77
	Phenanthrene	550	182	1.01	1400	216	1.47	171	46.16	1.15	0.95	0.63	0.67	1.02	0.44	0.44	0.92	0.73	0.80
	Pyrene	1550	917	0.51	3820	846	1.27	373	107	1.11	0.82	0.68	0.83	0.69	0.56	0.82	0.87	0.76	0.87
	Low Molecular Weight PAHs	1110	680	0.48	1654	509	1.06	233	103	0.77	0.68	0.63	0.93	0.62	0.53	0.85	0.70	0.70	1.01
	High Molecular Weight PAHs	9212	5298	0.54	20406	4640	1.26	1923	776	0.85	0.84	0.63	0.76	0.72	0.60	0.83	0.89	0.69	0.78
	Sum of PAHs	10322	5978	0.53	22060	5149	1.24	2156	879	0.84	0.83	0.63	0.77	0.71	0.59	0.83	0.88	0.69	0.79
PCBs	Total PCBs (Sum Congenersx2)	217	201	0.07	367	221	0.50	92.31	39.93	0.79	0.50	0.52	1.03	0.59	0.36	0.61	0.46	0.60	1.29
Pesticides	Aldrin		0.10		0.18	0.10	0.56		0.10		-5.03E-02	0.57	-11.40	0.56		0.00	-0.36	0.31	-0.86
	Hexachlorobenzene	0.10	0.08	0.26	0.12	0.08	0.39	0.24	0.08	1.01	0.48	0.54	1.11	0.25	0.20	0.80	0.60	0.64	1.07
	Mirex	0.23	0.71	-1.02	0.32	0.33	-0.01	0.09	0.10	-0.14	-4.94E-01	1.04	-2.11	-8.90E-03		0.00	-0.62	1.16	-1.89
	o,p'-DDE	2.39	0.26	1.61	6.26	3.63	0.53	1.18	0.63	0.60	0.67	0.54	0.81	0.36	0.56	1.54	0.80	0.52	0.65
	p,p'-DDE	1.79	2.38	-0.28		1.95		0.76	0.42	0.58	0.31	0.99	3.24	0.22	0.73	3.26	0.33	1.13	3.37
TOC	% TOC	4.21	3.57	0.16	3.29	3.84	-0.16	1.15	1.66	-0.36	0.08	0.64	-1.57	-1.61E-01	0.63	-3.90	0.18	0.67	3.70
	All CoCs	0.17			0.45			0.52			0.36	0.72	0.79	0.24	0.52	1.98	0.42	0.78	2.49
	PRGs[4]	.			0.42			0.55			0.47	0.52	2.27	0.33	0.40	0.32			
	Station Separation Distance (m)	29.63			28.09			47.87									0.53	0.56	1.41

1 - ERA Sediment data source: Table A-2.1A; URI Sediment data source: Table A-2.1B.
2 - RPD = Relative Percent Difference of co-located station sediment concentrations (URI vs. ERA, respectively). See Figure 3.2-1 for station locations.
3 - CV = Coefficient of Variation of mean RPD across station pairs.
4 - PRGs identified in Table 16 for aquatic exposure pathways.

Table A-10A. PRG Hazard Quotients[1] for CoCs in the aquatic exposure pathways for the Derecktor Shipyard/Coddington Cove study area:

ERA investigation.

Class	Analyte[2]	Aquatic Pathway[3]	Aquatic PRG	DSY-25	DSY-26	DSY-27	DSY-28	DSY-29	DSY-30	DSY-31	DSY-32	DSY-33	DSY-34	DSY-35	DSY-36	DSY-37	DSY-38	DSY-39	DSY-40	DSY-41
PAH	HMW PAHs	PW	6951	0.63	0.76	1.46	0.62	4.33	1.49	0.67	0.76	0.11	0.25	7.79E-03	0.47	0.28	0.22	0.23	0.71	0.04
PCB	Total PCBs	PW	1638	0.06	0.06	2.02	0.08	0.33	0.19	0.13	0.12	0.02	0.04	4.09E-03	0.07	0.06	0.04	0.04	0.05	8.40E-03
PST	o,p'-DDE	PW																		
	SUM PRG-HQ			0.68	0.82	3.48	0.70	4.67	1.68	0.80	0.88	0.14	0.29	0.01	0.54	0.34	0.25	0.27	0.76	0.05
	MAX PRG-HQ					2.02		4.33	1.49											
	MAX CoC					Total PCBs		HMW PAHs	HMW PAHs											
MET	Arsenic	ELU	24.63	0.26	0.38	0.47	0.35	0.51	0.42	0.41	0.44	0.30	0.39	0.14	0.46	0.30	0.36	0.31	0.28	0.46
MET	Copper	ELU	73.74	0.32	0.53	2.25	0.97	2.14	1.10	1.10	0.91	0.23	0.45	0.03	0.73	0.37	0.38	0.27	0.40	0.13
MET	Lead	ELU	83.94	0.43	0.48	1.80	0.93	2.21	0.95	0.96	1.49	0.48	0.57	0.17	0.94	0.68	0.74	0.64	0.50	0.20
PCB	Total PCBs	ELU	530	0.18	0.19	6.25	0.25	1.03	0.59	0.42	0.38	0.08	0.12	0.01	0.21	0.19	0.11	0.11	0.16	0.03
PST	o,p'-DDE	ELU	9.06	0.01	0.17	7.20	0.18	0.55	0.63	0.40	0.03	0.07	0.10	0.03	0.03	0.01	0.01	0.08	0.12	0.04
	SUM PRG-HQ			1.19	1.75	17.97	2.69	6.44	3.69	3.29	3.24	1.16	1.63	0.37	2.37	1.54	1.61	1.41	1.46	0.86
	MAX PRG-HQ			0.43	0.53	7.20	0.97	2.21	1.10	1.10	1.49	0.48	0.57		0.94	0.68	0.74	0.64	0.50	
	MAX PRG CoC					o,p'-DDE		Lead	Copper	Copper	Lead									

1 - Aquatic PRG-HQ = sediment CoC concentration(Table A-2.1A)/Aquatic pathway-specific Preliminary Remediation Goal (PRG) (Table 16).

2 - Sum PRG-HQ = sum of PRG-HQs for all analytes at a given station.

   Max PRG-HQ = maximum PRG-HQs observed for all analytes at a given station.

3 - PW - bedded sediment exposure pathway, CoCs measured in porewater (PW); ELU- Resuspended sediment exposure pathway, CoCs measured in sediment elutriates (ELU).

Table A-10B. PRG Hazard Quotients[1] for CoCs in the aquatic exposure pathways for the Derecktor Shipyard/Coddington Cove study area:

URI Investigations.

Class	Analyte[2]	Aquatic Pathway[3]	Aquatic PRG	DSY-1	DSY-2	DSY-3	DSY-4	DSY-5	DSY-6	DSY-7	DSY-8	DSY-9	DSY-10	DSY-11	DSY-12	DSY-13	DSY-14	DSY-15	DSY-16	DSY-17	DSY-18	DSY-19
PAH	HMW PAHs	PW	6951	0.58	9.21	10.50	0.80	0.65	0.77	0.60	0.84	0.09	0.08	0.72	0.65	0.13	0.06	0.45	0.03	0.49	1.85	1.33
PCB	Total PCBs	PW	1638	0.04	0.13	0.45	0.12	0.06	0.08	0.04	0.09	0.02	0.01	0.40	0.11	0.01	0.01	0.03	0.01	0.15	0.18	0.13
PST	o,p'-DDE	PW																				
		SUM PRG-HQ		0.62	9.33	10.94	0.91	0.72	0.85	0.65	0.93	0.11	0.08	1.12	0.75	0.14	0.08	0.48	0.04	0.64	2.03	1.46
		MAX PRG-HQ			9.21	10.50								0.72							1.85	1.33
	MAX CoC				HMW PAHs	HMW PAHs															HMW PAHs	HMW PAHs
MET	Arsenic	ELU	24.63																			
MET	Copper	ELU	73.74	0.62	2.67	3.56	0.85	0.71	0.78	0.38	1.03	0.05	0.17	1.10	0.73	0.25	0.11	0.25	0.09	0.23	1.11	0.91
MET	Lead	ELU	83.94	0.42	2.15	2.40	0.61	0.52	0.58	0.38	0.60	0.18	0.26	0.55	0.55	0.42	0.34	0.50	0.38	0.39	0.72	0.69
PCB	Total PCBs	ELU	530	0.13	0.39	1.38	0.37	0.20	0.25	0.14	0.28	0.05	0.02	1.24	0.33	0.04	0.04	0.10	0.02	0.46	0.55	0.41
PST	o,p'-DDE	ELU	9.06	0.11	0.63	0.42	0.44	0.32	0.29	0.17	0.23	0.04	0.08	0.96	0.27	0.08	0.05	0.17	0	0.07	0.48	0.26
		SUM PRG-HQ		1.27	5.85	7.76	2.28	1.75	1.90	1.07	2.15	0.33	0.54	3.86	1.88	0.79	0.54	1.03	0.48	1.16	2.86	2.27
		MAX PRG-HQ		0.62	2.67	3.56	0.85	0.71	0.78	0.38	1.03			1.24	0.73			0.50		0.46	1.11	0.91
	MAX PRG CoC			Copper	Copper						Copper			PCBs							Copper	Copper

1 - Aquatic PRG-HQ = sediment CoC concentration(Table A-2.1B)/Aquatic pathway-specific Preliminary Remediation Goal (PRG) (Table 16).
2 - Sum PRG-HQ = sum of PRG-HQs for all analytes at a given station.
   Max PRG-HQ = maximum PRG-HQs observed for all analytes at a given station.
3 - PW - bedded sediment exposure pathway, CoCs measured in porewater (PW); ELU- Resuspended sediment exposure pathway, CoCs measured in sediment elutriates (ELU).

Table A-10B (continued). PRG Hazard Quotients[1] for CoCs in the aquatic exposure pathways for the Derecktor Shipyard/Coddington Cove study area:

URI Investigations.

Class	Analyte[2]	Aquatic Pathway[3]	Aquatic PRG	DSY-20	DSY-21	DSY-22	DSY-23	DSY-24
PAH	HMW PAHs	PW	6951	2.94	0.28	0.47	0.03	0.49
PCB	Total PCBs	PW	1638	0.22	0.06	0.11	0.01	0.15
PST	o,p'-DDE	PW						
	SUM PRG-HQ			3.16	0.33	0.58	0.04	0.64
	MAX PRG-HQ			2.94				
	MAX CoC			HMW PAHs				
MET	Arsenic	ELU	24.63					
MET	Copper	ELU	73.74	1.08	0.40	0.70	0.09	0.23
MET	Lead	ELU	83.94	0.92	0.50	0.63	0.38	0.39
PCB	Total PCBs	ELU	530	0.69	0.17	0.34	0.02	0.46
PST	o,p'-DDE	ELU	9.06	0.69	0.13	0.28	0	0.07
	SUM PRG-HQ			3.38	1.20	1.94	0.48	1.16
	MAX PRG-HQ			1.08	0.50	0.70		0.46
	MAX PRG CoC			Copper				

1 - Aquatic PRG-HQ = sediment CoC concentration(Table A-2.1B)/Aquatic pathway-specific Preliminary Remediation Goal (PRG) (Table 16).

2 - Sum PRG-HQ = sum of PRG-HQs for all analytes at a given station.
    Max PRG-HQ = maximum PRG-HQs observed for all analytes at a given station.

3 - PW - bedded sediment exposure pathway, CoCs measured in porewater (PW); ELU- Resuspended sediment exposure pathway, CoCs measured in sediment elutriates (ELU).

Table A-11A. PRG Hazard Quotients[1] for CoCs in the avian predator exposure pathway for the Derecktor Shipyard/Coddington Cove study area.

ERA investigation.

Class	Analyte[2]	AV-PRG	DSY-25	DSY-26	DSY-27	DSY-28	DSY-29	DSY-30	DSY-31	DSY-32	DSY-33	DSY-34	DSY-35	DSY-36	DSY-37	DSY-38	DSY-39	DSY-40	DSY-41
MET	Arsenic	17.09	0.37	0.55	0.68	0.51	0.73	0.60	0.60	0.64	0.43	0.57	0.20	0.66	0.43	0.52	0.44	0.40	0.67
MET	Copper	184	0.13	0.21	0.90	0.39	0.86	0.44	0.44	0.36	0.09	0.18	0.01	0.29	0.15	0.15	0.11	0.16	0.05
MET	Lead	622000	5.77E-05	6.50E-05	2.42E-04	1.25E-04	2.99E-04	1.29E-04	1.30E-04	2.01E-04	6.43E-05	7.65E-05	2.25E-05	1.27E-04	9.15E-05	1.00E-04	8.68E-05	6.77E-05	2.73E-05
MET	Silver	2342	1.12E-04	8.00E-05	2.94E-04	2.19E-04	3.36E-04	3.15E-04	2.19E-04	3.47E-04	1.01E-04	1.23E-04	2.77E-05	2.40E-04	1.65E-04	6.94E-05	1.12E-04	9.07E-05	2.77E-05
MET	Zinc	118	0.94	0.86	4.65	1.44	3.34	1.64	1.42	1.71	0.61	0.90	0.24	1.23	0.79	0.93	0.83	0.85	0.40
PCB	Total PCBs	92.82	1.01	1.06	35.66	1.44	5.89	3.40	2.38	2.16	0.43	0.70	0.07	1.22	1.08	0.64	0.63	0.91	0.15
	SUM PRG-HQ		2.44	2.69	41.90	3.78	10.81	6.08	4.84	4.88	1.57	2.34	0.52	3.40	2.45	2.24	2.01	2.32	1.27
	MAX PRG-HQ		1.01	1.06	35.66	1.44	5.89	3.40	2.38	2.16				3.40	2.45				
	MAX PRG CoC		Total PCBs	Total PCBs	Total PCBs	Total PCBs	Total PCBs	Total PCBs	Total PCBs	Total PCBs				Zinc	Total PCBs				

1 - Avian PRG-HQ = sediment CoC concentration (Table A-2.1)/Avian (HQ=1) Preliminary Remediation Goal (PRG) (Table 16).
2 - Sum PRG-HQ = sum of PRG-HQs for all analytes at a given station.
   Max PRG-HQ = maximum PRG-HQs observed for all analytes at a given station.

Table A-11B. PRG Hazard Quotients[1] for CoCs in the avian predator exposure pathway for the Derecktor Shipyard/Coddington Cove study area.

URI investigation.

Class	Analyte[2]	AV-PRG	DSY-1	DSY-2	DSY-3	DSY-4	DSY-5	DSY-6	DSY-7	DSY-8	DSY-9	DSY-10	DSY-11	DSY-12	DSY-13	DSY-14	DSY-15	DSY-16
MET	Arsenic	17.09	0.25	1.07	1.43	0.34	0.28	0.31	0.15	0.41	0.02	0.07	0.44	0.29	0.10	0.04	0.10	0.03
MET	Copper	184																
MET	Lead	622000	5.69E-05	2.91E-04	3.23E-04	8.26E-05	6.96E-05	7.81E-05	5.10E-05	8.14E-05	2.39E-05	3.56E-05	7.41E-05	7.39E-05	5.66E-05	4.65E-05	6.76E-05	5.07E-05
MET	Silver	2342	2.56E-04	3.51E-04	5.41E-04	5.88E-03	9.91E-04	6.80E-04	2.31E-03	7.42E-04	3.13E-04	2.41E-04	5.23E-04	6.75E-04	2.72E-05	2.27E-05	2.28E-05	2.02E-05
MET	Zinc	118	1.27	5.04	10.47	1.61	1.47	1.49	1.01	1.57	0.50	0.54	9.39	1.37	0.76	0.57	0.71	0.41
PCB	Total PCBs	92.82	0.73	2.25	7.90	2.10	1.14	1.42	0.79	1.60	0.30	0.13	7.09	1.90	0.24	0.25	0.59	0.10
	SUM PRG-HQ		2.25	8.37	19.80	4.05	2.89	3.23	1.95	3.58	0.83	0.74	16.92	3.56	1.10	0.86	1.40	0.55
	MAX PRG-HQ		1.27	5.04	10.47	2.10	1.47	1.49	1.01	1.60			9.39	1.90				
	MAX PRG CoC		Zinc	Zinc	Zinc	Total PCBs	Zinc	Zinc	Zinc	Total PCBs			Zinc	Total PCBs				

1 - Avian PRG-HQ = sediment CoC concentration (Table A-2.1)/Avian (HQ=1) Preliminary Remediation Goal (PRG) (Table 16).

2 - Sum PRG-HQ = sum of PRG-HQs for all analytes at a given station.

Max PRG-HQ = maximum PRG-HQs observed for all analytes at a given station.

Table A-11B (continued). PRG Hazard Quotients[1] for CoCs in the avian predator exposure pathway for the Shipyard/Coddington Cove study area.

URI investigation.

Class	Analyte[2]	DSY-17	DSY-18	DSY-19	DSY-20	DSY-21	DSY-22	DSY-23	DSY-24
MET	Arsenic								
MET	Copper	0.09	0.44	0.36	0.43	0.16	0.28	0.27	0.08
MET	Lead	5.29E-05	9.68E-05	9.30E-05	1.24E-04	6.73E-05	8.44E-05	8.71E-05	6.29E-05
MET	Silver	2.28E-05	6.79E-05	1.71E-04	3.77E-04	3.51E-05	5.22E-05	5.22E-05	2.36E-05
MET	Zinc	0.61	1.39	1.19	1.34	1.49	1.21	1.19	0.83
PCB	Total PCBs	2.63	3.15	2.33	3.95	0.99	1.92	1.62	0.28
	SUM PRG-HQ	3.33	4.99	3.88	5.73	2.64	3.41	3.08	1.19
	MAX PRG-HQ	2.63	3.15	2.33	3.95	1.49	1.92	1.62	
	MAX PRG CoC	Total PCBs	Total PCBs	Total PCBs	Total PCBs	Zinc	Total PCBs	Total PCBs	

1 - Avian PRG-HQ = sediment CoC concentration (Table A-2.1)/Avian (HQ=1) Preliminary Remediation Goal (PRG) (Table 16).

2 - Sum PRG-HQ = sum of PRG-HQs for all analytes at a given station.

Max PRG-HQ = maximum PRG-HQs observed for all analytes at a given station.

Table A-12A. PRG Hazard Quotients[1] for CoCs in the human health exposure pathway for the Derecktor Shipyard/Coddington Cove study area.

ERA investigation.

Class	Analyte[2]	HH-PRG	DSY-25	DSY-26	DSY-27	DSY-28	DSY-29	DSY-30	DSY-31	DSY-32	DSY-33	DSY-34	DSY-35	DSY-36	DSY-37	DSY-38	DSY-39	DSY-40	DSY-41
MET	Arsenic	19.74	0.32	0.48	0.59	0.44	0.63	0.52	0.52	0.55	0.37	0.49	0.17	0.57	0.38	0.45	0.38	0.34	0.58
PAH	Benzo(a)pyrene	53.92	7.34	8.05	17.14	7.00	44.14	15.06	7.80	9.17	1.26	2.74	0.08	5.92	3.04	2.22	2.65	5.87	0.34
	SUM PRG-HQ		7.66	8.53	17.72	7.44	44.77	15.58	8.32	9.73	1.63	3.23	0.25	6.49	3.41	2.68	3.04	6.22	0.92
	MAX PRG-HQ		7.34	8.05	17.14	7.00	44.14	15.06	7.80	9.17	1.26	2.74		5.92	3.04	2.22	2.65	5.87	
	MAX PRG CoC		Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene		Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	

1 - Human Health PRG-HQ = sediment CoC concentration(Table A-2.1)/HH (HQ=1) Preliminary Remediation Goal (PRG) (Table 16).

2 - Sum PRG-HQ = sum of PRG-HQs for all analytes at a given station.

Max PRG-HQ = maximum PRG-HQs observed for all analytes at a given station.

Table A-12B. PRG Hazard Quotients[1] for CoCs in the human health exposure pathway for the Derecktor Shipyard/Coddington Cove study area.

URI Investigation.

Class	Analyte[2]	HH-PRG	DSY-1	DSY-2	DSY-3	DSY-4	DSY-5	DSY-6	DSY-7	DSY-8	DSY-9	DSY-10	DSY-11	DSY-12	DSY-13	DSY-14	DSY-15	DSY-16	DSY-17	DSY-18	DSY-19	DSY-20	DSY-21	DSY-22	DSY-23	DSY-24
MET	Arseric	19.74																								
PAH	Benzo(a)pyrene	53.92	3.04	61.57	87.35	8.00	7.45	9.06	5.60	8.92	0.91	0.71	3.83	4.61	0.81	0.48	4.54	0.22	5.76	22.07	9.20	16.33	2.03	3.38	4.44	1.01
	SUM PRG-HQ		3.04	61.57	87.35	8.00	7.45	9.06	5.60	8.92	0.91	0.71	3.83	4.61	0.81	0.48	4.54	0.22	5.76	22.07	9.20	16.33	2.03	3.38	4.44	1.01
	MAX PRG-HQ		3.04	61.57	87.35	8.00	7.45	9.06	5.60	8.92	0.91	0.71	3.83	4.61	0.81	0.48	4.54	0.22	5.76	22.07	9.20	16.33	2.03	3.38	4.44	1.01
	MAX PRG CoC		Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene			Benzo(a) pyrene	Benzo(a) pyrene			Benzo(a) pyrene		Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene

1 - Human Health PRG-HQ = sediment CoC concentration(Table A-2.1)/HH (HQ=1) Preliminary Remediation Goal (PRG) (Table 16).
2 - Sum PRG-HQ = sum of PRG-HQs for all analytes at a given station.
  Max PRG-HQ = maximum PRG-HQs observed for all analytes at a given station.

Table A-13. Summary of maximum PRG-HQs and identification of Limiting CoCs by sampling location for aquatic, avian, and human health exposure pathways for the Derecktor Shipyard study area.

Exposure Pathway	Parameter	DSY-1	DSY-2	DSY-3	DSY-4	DSY-5	DSY-6	DSY-7	DSY-8	DSY-9	DSY-10	DSY-11	DSY-12	DSY-13	DSY-14	DSY-15	DSY-16
Aquatic (A-B)	PRG-HQ1,2		9.21	10.50								0.72					
Bedded Sediment	L-CoC		HMW PAHs	HMW PAHs													
Aquatic (A-R)	PRG-HQ1,2	0.62	2.67	3.56	0.85	0.71	0.78	0.38	1.03			1.24	0.73			0.50	
Resuspended Sediment	L-CoC		Copper	Copper					Copper			Total PCBs					
Avian Predator (P)	PRG-HQ1,3	1.27	5.04	10.47	2.10	1.47	1.49	1.01	1.60			9.39	1.90				
	L-CoC	Zinc	Zinc	Zinc	Total PCBs	Zinc	Zinc	Zinc	Total PCBs			Zinc	Total PCBs				
Human Health (HH)	PRG-HQ1,4	3.04	61.57	87.35	8.00	7.45	9.06	5.60	8.92			3.83	4.61			4.54	
	L-CoC	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene			Benzo(a) pyrene	Benzo(a) pyrene			Benzo(a) pyrene	
Combined	PRG-HQ1,5	3.04	61.57	87.35	8.00	7.45	9.06	5.60	8.92			3.83	4.61			4.54	
Exposure	L-CoC	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene			Benzo(a) pyrene	Benzo(a) pyrene			Benzo(a) pyrene	
Pathway	Pathway	HH	HH	HH	HH	HH	HH	HH	HH			HH	HH			HH	

PRG-HQ=Preliminary Remediation Goal Hazard Quotient. L-CoC=Limiting Chemical of Concern. See text, Section 1.0. PRG-HQs<1 not reported.
1 - PRG-HQ = analyte pathway-specifc concentration/analyte-pathway-specific TEV value.
2 - Values presented are maximum of Aquatic PRG-HQs by station. Complete PRG-HQ values presented in Tables A-10A and A-10B.
3 - Values presented are maximum of Avian Predator PRG-HQs by station. Complete PRG-HQ values presented in Table A-11A and A-11-B.
4 - Values presented are maximum of Human Health PRG-HQs by station. Complete PRG-HQ values presented in Table A-12A and A-12B.
5 - Values presented are maximum of individual exposure pathway PRG-HQs by station.

Table A-13 (continued). Summary of maximum PRG-HQs and identification of Limiting CoCs by sampling location for aquatic, avian, and human health exposure pathways for the Derecktor Shipyard study area.

Exposure Pathway	Parameter	DSY-17	DSY-18	DSY-19	DSY-20	DSY-21	DSY-22	DSY-23	DSY-24	DSY-25	DSY-26	DSY-27	DSY-28	DSY-29	DSY-30	DSY-31	DSY-32
Aquatic (A-B)	PRG-HQ1,2		1.85	1.33	2.94							2.02		4.33	1.49		
Bedded Sediment	L-CoC		HMW PAHs	HMW PAHs	HMW PAHs							Total PCBs		HMW PAHs	HMW PAHs		
Aquatic (A-R)	PRG-HQ1,2	0.46	1.11	0.91	1.08	0.50	0.70		0.46	0.43	0.53	7.20	0.97	2.21	1.10	1.10	1.49
Resuspended Sediment	L-CoC		Copper		Copper							o,p'-DDE		Lead	Copper	Copper	Lead
Avian Predator (P)	PRG-HQ1,3	2.63	3.15	2.33	3.95	1.49	1.92	1.62		1.01	1.06	35.66	1.44	5.89	3.40	2.38	2.16
	L-CoC	Total PCBs	Total PCBs	Total PCBs	Total PCBs	Zinc	Total PCBs	Total PCBs		Total PCBs	Total PCBs	Total PCBs	Total PCBs	Total PCBs	Total PCBs	Total PCBs	Total PCBs
Human Health (HH)	PRG-HQ1,4	5.76	22.07	9.20	16.33	2.03	3.38	4.44	1.01	7.34	8.05	17.14	7.00	44.14	15.06	7.80	9.17
	L-CoC	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene
Combined	PRG-HQ1,5	5.76	22.07	9.20	16.33	2.03	3.38	4.44	1.01	7.34	8.05	17.14	7.00	44.14	15.06	7.80	9.17
Exposure	L-CoC	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene
Pathway	Pathway	HH	HH	HH	HH	HH	HH	HH	HH	HH	HH	HH	HH	HH	HH	HH	HH

PRG-HQ=Preliminary Remediation Goal Hazard Quotient. L-CoC=Limiting Chemical of Concern. See text, Section 1.0. PRG-HQs<1 not reported.
1 - PRG-HQ = analyte pathway-specifc concentration/analyte-pathway-specific TEV value.
2 - Values presented are maximum of Aquatic PRG-HQs by station. Complete PRG-HQ values presented in Tables A-10A and A-10B.
3 - Values presented are maximum of Avian Predator PRG-HQs by station. Complete PRG-HQ values presented in Table A-11A and A-11-B.
4 - Values presented are maximum of Human Health PRG-HQs by station. Complete PRG-HQ values presented in Table A-12A and A-12B.
5 - Values presented are maximum of individual exposure pathway PRG-HQs by station.

Table A-13 (continued). Summary of maximum PRG-HQs and identification of Limiting CoCs by sampling location for aquatic, avian, and human health exposure pathways for the Derecktor Shipyard study area.

Exposure Pathway	Parameter	DSY-33	DSY-34	DSY-35	DSY-36	DSY-37	DSY-38	DSY-39	DSY-40	DSY-41
Aquatic (A-B)	PRG-HQ1,2									
Bedded Sediment	L-CoC									
Aquatic (A-R)	PRG-HQ1,2	0.48	0.57		0.94	0.68	0.74	0.64	0.50	
Resuspended Sediment	L-CoC									
Avian Predator (P)	PRG-HQ1,3				1.23	1.08				
	L-CoC				Zinc	Total PCBs				
Human Health (HH)	PRG-HQ1,4	1.26	2.74		5.92	3.04	2.22	2.65	5.87	
	L-CoC	Benzo(a) pyrene	Benzo(a) pyrene		Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	
Combined	PRG-HQ1,5	1.26	2.74		5.92	3.04	2.22	2.65	5.87	
Exposure	L-CoC	Benzo(a) pyrene	Benzo(a) pyrene		Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	Benzo(a) pyrene	
Pathway	Pathway	HH	HH		HH	HH	HH	HH	HH	

PRG-HQ=Preliminary Remediation Goal Hazard Quotient. L-CoC=Limiting Chemical of Concern. See text, Section 1.0. PRG-HQs<1 not reported.
1 - PRG-HQ = analyte pathway-specifc concentration/analyte-pathway-specific TEV value.
2 - Values presented are maximum of Aquatic PRG-HQs by station. Complete PRG-HQ values presented in Tables A-10A and A-10B.
3 - Values presented are maximum of Avian Predator PRG-HQs by station. Complete PRG-HQ values presented in Table A-11A and A-11-B.
4 - Values presented are maximum of Human Health PRG-HQs by station. Complete PRG-HQ values presented in Table A-12A and A-12B.
5 - Values presented are maximum of individual exposure pathway PRG-HQs by station.